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SUNSTROKE AND SOME OF ITS SEQUELÆ.

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UNDER the designations of sunstroke, coup-de-soleil, heat apoplexy, heat asphyxia, thermic fever, ardent fever, insolation, and others, are included certain pathological states, which though differing from each other materially are not unfrequently confounded.

1st. There is simple syncope from exhaustion caused by heat.

2nd. A condition analogous to shock, due to the action of the direct rays of a powerful sun on the brain and cord; the nerve-centres, especially the respiratory, are affected; respiration and circulation rapidly fail, and death may result; recovery is frequent, though not always perfect.

3rd. Overheating of the whole body, blood, and nerve centres, either from direct exposure to the sun's rays, or more frequently, to a high temperature out of them; causing vasomotor paralysis and intense pyrexia; respiration and circulation fail, and asphyxia follows. Recovery frequently occurs, but is often incomplete, owing to structural changes in the centres, giving origin to a variety of symptoms indicative of lesions of a grave character, some of which are well illustrated in the cases subsequently cited.

The cases of simple exhaustion and syncope may occur during great fatigue or over-exertion, or when there is depression of vital power from any cause during exposure to a high temperature, as in the case of the stokers and engine-room men of steamers in the Red Sea or the tropics, when the temperature rises to 120° and upwards, in the vicinity of the furnaces where they are employed; or in the case of men, especially Europeans, in the tropics who are exposed to the intense heat and light of the sun's rays, which taking effect on the head, neck, and body, produce a condition like shock acting through the vagus and vaso-motor system. There is depression of nerve force and of muscular power; the skin is pale, cold, and moist, the pulse feeble. Death may occur in this state from failure of the heart; but complete recovery more frequently occurs. Asphyxia and apnœa may come on after premonitory symptoms of depression and weakness, during exposure of the head and spine to the direct rays of a powerful sun, when the atmosphere is much heated, and the nervous energy is depressed by over fatigue, illness, or dissipation. The brain and respiratory nerve-centres are overwhelmed by the sudden rise of their temperature, respiration and circulation fail, the latter probably owing to inhibitory action of the vagus. When death takes place very suddenly during great excitement or exertion, and exposure to heat, it has been ascribed to rapid coagulation of cardiac-myosin.

This, however, though it *may* occur occasionally, is generally a post-mortem change; the heart's action being really brought to a close by heat, in the same manner as it has been shown by Claude Bernard and Lauder Brunton, that the effect of a very high temperature on animals is first to accelerate, and finally to stop the heart, and especially the ventricles, in a state of tetanic contraction.

Recovery, though frequently complete, is sometimes tedious, and occasionally imperfect, ending in serious impairment of health or intellect.

The symptoms of this form of sunstroke are those of sudden and violent lesion of the nerve-centres, unconsciousness, cold shivers, feeble pulse; all the signs of depression, terminating in death by shock; or fatal reaction may result, with a

variety of conditions pointing to injury to the cerebro-spinal system. In another class of cases there is ardent fever, the body generally, including the nerve centres, is heated intensely; this may occur quite independently of the direct action of the sun's rays. It comes on frequently at night, or in the shade, in a building or tent, especially in persons who are depressed by fatigue, bad air, over feeding, alcoholic stimulants and the consequent depression, want of rest, illness, and notably when the air is impure from overcrowding, or from insufficiency of cubic space.

The temperature of the body may rise to 108°–110°; respiration and circulation fail; there is dyspnœa, hurried gasping respiration, great restlessness; pungently hot skin, sometimes dry, occasionally moist. The pulse varies; in some it is full and labouring, in others quick and jerking; the head, face, and neck are livid and congested; the carotid pulsation very perceptible; pupils, at first contracted, dilate widely before death. Coma, stertor, delirium, convulsions, frequently epileptiform in character, with relaxation of sphincter, and suppression of urine, these are the precursors of death by asphyxia, and it may be that there is cerebral hæmorrhage.

Such are the cases to which the term heat apoplexy is given; and a large proportion of the fatal cases among Europeans in India is so caused. Recovery may partially occur, to be followed by relapse and death, or secondary consequences, the result of tissue change, may destroy life or impair health and intellect at a later period. The premonitory symptoms of this form of the disease may appear some hours or even days before the dangerous condition just described supervenes. There may be general malaise, disordered secretions, profuse and frequent micturition, restlessness, insomnia, apprehension of impending evil, hurried and shallow breathing, precordial anxiety, gasping, giddiness, headache, occasionally nausea or vomiting, thirst, anorexia, feverishness, which soon amounts to fervent heat of skin; the surface may be dry or moist, the pulse varies; and these conditions gradually become aggravated and frequently are worse at night, when the patient passes into a state of unconsciousness and dies.

The symptoms point to a profoundly disturbed state of the

cerebro-spinal nerve centres, and to pathological changes in the organs whose functions have been so greatly disturbed.

Death is caused by asphyxia and apnœa, in some cases probably by cerebral hæmorrhage. Recovery is often incomplete, resulting in permanent impairment of health, and generally in intolerance of heat and of exposure to the sun. These morbid conditions being due to heat alone are liable to occur whenever there is exposure to a high temperature, whether solar or artificial. Soldiers marching or fighting, when oppressed by weight of clothing or accoutrements, are apt to suffer either from simple heat exhaustion or from that form of insolation which results from direct action of a powerful sun on the head and spine. This is common enough in India and elsewhere during the hot season. It is not unknown in Europe, even in England during the dog-days. Soldiers, labourers, artificers, and people in factories, heated rooms, hospitals, barracks, tents, and even ships, may suffer from heat exhaustion, which may pass into the same dangerous condition of heat asphyxia. People in the hay-field, or otherwise exposed to great heat in this country, especially if they have indulged in excess of alcoholic stimulants and food, may suffer.

Men serving in the engine-room of steamers in the tropics —the Red Sea for instance—are often brought on deck in a state of complete exhaustion, from which they generally recover under the reviving influence of the cooler air, a douche of cold water, or a stimulant; weak persons with defective hearts may die in this state of syncope. Soldiers, or others, when exposed to great heat, may drop out of the ranks, fall in a state of syncope, and die on the spot, or pass into a state of coma and die later; or they may recover, after being in great danger, with damaged nerve-centres, and are rendered quite unfit for further service, or even residence in a hot climate. These cases occur on exposure to the direct action of the sun's rays when the atmospheric temperature is also high, and especially when unusual exertion is made, or when the individual is depressed by previous illness or the exhaustion due to dissipation, intemperance, or even undue indulgence in stimulants.

But the most serious cases are those that come on under

cover by night as well as by day, and apart from the direct solar rays. A form of disease described in India as ardent fever is of this character, supervening on the ordinary phenomenon of ephemeral fever. Heat alone, especially when the atmosphere is loaded with moisture so as to prevent evaporation from the person, is the real cause of the disease. Malarious and hygrometric conditions have no special influence beyond that which they may exert on the general vigour of the constitution, thus predisposing him to suffer.

The dry atmosphere of Upper India, with its hot winds, is much better tolerated than the damp atmosphere of Lower Bengal or Southern India, though the temperature is lower. Hot dry air favours evaporation, and thus keeps the body cool, whilst in the damp air, as evaporation is diminished, the natural cooling power is greatly diminished.

Vigorous, healthy persons of moderately spare frame, with sound viscera, and who are of temperate habits, if the atmosphere be pure and moderately dry, can sustain a great amount of heat. Acclimatisation has also some influence in conferring toleration. Fresh arrivals in the tropics are more prone to suffer than those who have become accustomed to the climate and have learned how to protect themselves. It is well known that a native can bear an amount of sun on his bare head and naked body with indifference, almost pleasure, that would rapidly prostrate a European. But when the temperature rises above a certain standard all succumb, and natives of India suffer and die like others in numbers every year from "loo marna," hot-wind stroke.

The extent and duration of the toleration of heat depend much on the vigour of constitution and actual state of health. The refrigerating powers of the body, when in health, enable it to support a very high temperature, considerably above that of the blood. Thus in the hot winds little inconvenience is felt so long as perspiration is free, but when that fails, suffering soon ensues, and the danger is great.

In the Fourteenth Annual Report of the Sanitary Commissioner with the Government of India, 1877, it is stated that 235 cases of heat apoplexy and sunstroke occurred in the army in India, of which 70 were fatal. The admission rate,

4·1, is almost the same as in 1876, and exactly the same as in 1865. The death rate, 1·22, is below the average of the last six years. There is nothing calling for special remark in the ratios of the different Presidencies as compared with their former history. Of the 235 cases, 189 occurred during the four months of May to August. The disease was widely spread. In proportion to strength there is no remarkable number of attacks at any one place. It gives rise to a fatality of 12·2 per cent. in the first and second years of the European soldier's service in India.

The deaths per 1000 strength :—

Service.

1 to 4 years.	5 to 7 years.	above 7 years.
1·48	1·05	1·50

Age.

Under 25.	25 to 29.	30 and upwards.
·65	·99	2·33

But of those who recover, or rather who do not die, many are permanently injured and remain invalids for the rest of life, which is frequently shortened by the changes induced; and the cases hereafter cited, for which I am indebted to Dr. Christie, the able superintendent of the Royal Indian Asylum at Ealing, will show what sad effects sunstroke may have on Europeans in India. These may be due to obscure cerebral or meningeal changes, which affect the sufferer in various degrees of intensity. Irritability, impaired memory, epilepsy or epileptiform attacks, headache, mania, partial or complete paraplegia, partial or complete blindness, extreme intolerance of heat, especially of the sun's rays, rendering a person otherwise fairly healthy quite incapable of serving in hot climates or of enduring any exposure to the sun; or, it may be, gradually ending in complete fatuity, dementia, or epilepsy,

perchance both: chronic meningitis, with thickening of calvarium, accounting for the intense cephalalgia; or in a lesser degree in disordered innervation and general functional derangement, which seriously compromise health.

In cases where death has occurred suddenly, as from syncope or shock, there is no very remarkable morbid change. The heart may be firmly contracted—it has been found in animals that died from exposure to a high temperature, when the blood and nerve-centres were heated to 110°, 112°, or higher, that the heart was tetanically contracted—but not always so, for it is often flaccid. The lungs, brain, and its membranes may be congested, but not invariably; they are sometimes quite the reverse. As in cases of shock, the venous trunks, especially those of the abdomen, and the right side of the heart itself, may be filled with blood. The blood is dark and grumous, often imperfectly coagulated, and effused in patches of ecchymosis, rendering the body rapidly livid. The coagulability of the blood is impaired, and it is deficient in oxygen.

In death from ordinary cases of thermic fever (insolation), the lungs and pulmonary system are often deeply congested; the heart is firmly contracted with coagulation of myosin, and the whole venous system is engorged. The body, even before death, may be marked by petechial patches and extensive livid ecchymosis. The blood is generally more fluid and grumous than natural, and it may be acid in reaction. The globules generally present no abnormal change in form, but are sometimes crenated and have a diminished tendency to form into rouleaux. The body for some time after death retains a high temperature. When first opened, the viscera and interior feel pungently hot, and the incisions drip dark blood. Rigor mortis comes on very rapidly. The brain and membranes may be congested; in some cases there are evidences of cerebral hæmorrhage and serous effusions in the ventricles. But the disease is essentially asphyxia, not apoplexy.

In cases of simple exhaustion, remove the person to a cooler place, if possible. Give a douche, but not too prolonged, or it may over-depress. A stimulant may be useful; rouse, and

gently stimulate; remove tight and oppressive clothing. Treat as in ordinary syncope—ammonia to nostrils, &c.

Rest, and avoid exposure to over-fatigue or to great heat.

In the form of sunstroke where the person is struck down suddenly by a hot sun, remove him into the shade, and allow a douche of cold water to fall from a height on his head and body, from a pump (or from a mussuck in India), or other similar contrivance. This should be freely resorted to, the object being twofold: to reduce the temperature of the overheated centres, and to rouse by reflex action. During the assault on the "White House picket," at the capture of Rangoon in 1853, numbers of men were struck down by the fierce April sun. They were brought to me, and laid out in rows, perfectly unconscious, *in their red coats and black leather stocks* (they wore them, in those days, even in action under a tropical sun). They nearly all recovered—for the time, at all events—under the influence of the douche, freely applied over the head and body. In some cases, rousing by flagellation with the sweeper's broom was added with great effect, especially in the case of Brigadier-General W., who I thought must have died. All, or nearly all, recovered, except two, both of whom had been bled on the spot, before I saw them.

In addition to the douche, stimulants, such as mustard-plasters, to various parts of the body, legs, abdomen, &c., and stimulating enemata which relieve the loaded bowels and at the same time rouse, may be useful.

When I say such cases recovered, I refer to the reaction at the time. In some there were consecutive symptoms of fever, cephalalgia, &c.; and, were we able to trace their subsequent history, we should probably find that complete recovery never occurred. If recovery is incomplete, and followed by indications of lesion of nerve-centres, or of meningitis, other treatment of a more active character will be needed according to the conditions.

Future exposure to the sun should be carefully guarded against, and, unless recovery has been rapid and complete, the sufferer, if in India or the tropics, should be removed to a cooler climate, where he should be protected from all

excitement of mind or body, and the greatest care be taken not only to avoid all errors or excesses of diet, but also of stimulants.

In the graver cases of thermic fever, or heat asphyxia, heat being the primary cause of the disease, the object is to reduce temperature as speedily as possible and before tissue changes have been caused. As the hyperpyrexia is due not only to the direct operation of heat on the nerve-centres, blood, and tissues, but to the fever set up by vaso-motor disturbance, remedies that may influence this disturbed condition are indicated. The result of the treatment in some cases seems to confirm the correctness of the theory. The use of quinine and of morphia by hypodermic injection have both been considered to produce good results by their influence in reducing temperature and blood pressure, and perhaps retarding tissue change. The quinine, I think, may do so; I doubt the morphia.

Bleeding has now happily been abandoned except in rare and peculiar cases. The congested livid surface, the coma and stertor which formerly suggested it are not now so treated. There are cases in which it may be necessary in order to avert suffocation, but they are, I think, the exception. In cases where it has appeared at first to give relief and to mitigate the symptoms, the improvement has been only transient, and followed by relapse into a more dangerous and fatal condition.

I do not think any absolute rule in this or any disease can be laid down in regard to abstraction of blood. It is possible that there may be more danger to life in the labouring and distended heart and the embarrassed lungs, than in the loss of a few ounces of blood; which, if it would have tided the patient over the danger, as I believe it sometimes might do, would be the lesser evil, and as such should be chosen. Each case must be treated on its own merits.

The treatment generally, consists in the judicious application of cold by affusion, or by ice, taking care not to reduce temperature too low. A thermometer in the axilla, mouth, or rectum, will keep you informed in this respect.

Great care should be taken not to prolong the cold application too far, as danger would attend continued depression

of the temperature below the normal standard of blood heat. The bowels should be relieved, and blisters may be applied to the scalp and neck, though I cannot but say I have not much faith in their efficacy. In the epileptiform convulsions that so frequently occur, the inhalation of chloroform may be useful, but the administration of it must be carefully watched. The earliest and most severe symptoms having subsided, the febrile condition that follows is to be treated on ordinary principles; the diet must be carefully regulated. As improvement progresses, symptoms of intra-cranial mischief may begin to supervene; where the indications are of meningitis, iodide of potash and counter-irritation, may be of service; removal to a cooler climate is essential. As a general rule it is desirable that the sufferer should not, for a long period at least, return to a hot climate, and he should be guarded against all exposure to heat, overwork, and anxiety of any kind.

The sequelæ of sunstroke are often very distressing, and render the patient a source of anxiety and suffering to himself and to his friends.

The less severe symptoms—those probably of the slighter forms of meningitis, or of cerebral change—occasionally pass away after protracted residence in a cold climate; they are, however, not unfrequently the cause of suffering, but of danger to, and shortening of life; pointing to permanently disturbed if not structurally altered cerebro-spinal centres.

The following cases, for which I am indebted to Dr. Christie, are very illustrative of the evil effects that, more frequently than is perhaps imagined, result from sunstroke.

"My dear Sir,

"I send you, as far as I can learn them, short histories of seventeen cases of insanity following sunstroke. I believe the whole of them are uncomplicated with insobriety. As a rule, the previous histories are not very replete with information, and only in one or two cases have I therefore been able to go very fully into them.

"It appears that the attack in most cases was the same and of a violent character, the onset was of an inflammatory type from the symptoms displayed, gradually settling down into

imbecility; the few post-mortems gave confirmatory proof of this in the adherent and thickened membranes.

"The second case was interesting, as showing the violence of symptoms during the whole attack, and which appeared to arise from the pressure of the plates of the skull, not, however, altogether the result of the sunstroke, as there is evidence of injury when young; here a resemblance is observed in the case of Surgeon-Major M., in whose case the bony growths were hereditary, and the same violence of symptoms was exhibited. In no case was recovery complete; although improved, a certain amount of imbecility resulted.

"Looking at the result of the post-mortem, I am led to think that the worst of insanity after sunstroke is of an acute inflammatory character, attacking the membranes of the brain, and thus the grey substance, so that we find the mental symptoms more clearly defined than the physical; only in the one case of Surgeon-Major J. M. were the physical characters clearly marked, and in this case paralysis was permanent from the first onset of disease.

"How far an alteration of structure of bony growth may be traced to coup-de-soleil is a matter for further consideration; in all the cases I have had under care, the diploe has been found obstructed and the skull plates thickened, dense, and heavy, with, in two cases, distinct growth of bone; but both these cases are involved in their etiology, in the one case by an early injury, and in the other by a most decided hereditary taint.

"At the present time I have two cases under treatment, the one a case of acute mania, with partial recovery following coup-de-soleil in Bengal; the other a case that occurred last summer here in the country, not followed by actual mania, but an inability to use the brain as formerly, coupled with grave symptoms at the present time, such as headache, squinting, and incapability of fixing attention, coupled with sleeplessness. Of both of these cases I hope to get a complete history.

"Yours very truly,

"THOS. B. CHRISTIE."

Case 1.

"Gunner J. M., aged 71 years.

"Went to India in the year 1839, and was a steady, well-conducted soldier. On the 13th April, 1843, was admitted into hospital for coup-de-soleil, and was discharged as recovered May 29th following. He was readmitted on the 18th of June, complaining of pains in the head and abdomen, but was discharged again in three days. July 12th he was again admitted, having been drinking, and became very excited, but was discharged on Aug. 12th. This went on, till the excitement increasing, he was admitted into the asylum, Jan. 23rd, 1844, for hypochondria, but soon after showing symptoms of imbecility he was sent home to England. On board ship he became violent, on several occasions, attacking those about him and threatening to throw them overboard. He arrived in England, Sept. 1844, and was admitted into the Asylum at Hackney. Here his case ran through the usual course, resulting in dementia, with general incoherence of language and silliness of manner. He is a Roman Catholic, and many of his delusions relate to the fasts of the church, fancying e. g. that Saturday is a fast-day, and will not eat meat. He is still living, with symptoms of cerebral atrophy."

Case 2.

"Ensign P. F. T., age 51 years at death.

"This gentleman when about three years of age fell from a table and received a severe blow on the back of the head; very soon after he appeared drowsy and was sick, and in the course of a few days symptoms of acute inflammation of the brain came on, and he became perfectly unconscious. The attack soon subsided under active treatment, and he recovered. At the age of 17 he went to India, and within two years was attacked twice with fever, and apparently slight inflammation of the brain; subsequently, when exposed, he was struck down with coup-de-soleil, from which in a few days he apparently recovered. After this his correspondence was noticed to be irregular, and the style of his letters incoherent and

rambling. His conduct partook of the same character, until decided insanity necessitated his return to England. He recovered considerably on the voyage, and resided with his friends for a few years, during which they noticed a gradual increase of symptoms, till his violence was so great that he was sent to the Asylum at Hackney, where he was admitted July 18th, 1845, suffering from acute mania. His symptoms continued, and he became noisy, violent, fretful, and took a great dislike to his mother and relatives. In Aug. 1870 he was transferred to Ealing, and continued to show the same symptoms. On July 5th, 1871, he complained of great pain in the hepatic region, and he was ordered a purgative; this did not, however, remove the pain, and in two or three days violent diarrhœa came on, which was not checked by chlorodyne, opium, &c., &c.; on the 14th his temperature was $98\frac{2}{5}$, and pulse 100; there was no tenderness, and the skin was acting freely. July 16th, temperature $99\frac{2}{5}$, but the pulse fell to 98, the diarrhœa continuing with blood; this went on till the 24th, when he died.

"Post-mortem revealed an enormously enlarged liver, and adherent to the diaphragm: on attempting to separate it, an abscess of the size of a cricket-ball burst, in addition to which the right lobe was found to contain six separate and distinct cavities. Intestines congested, villi distinct with ulceration of the glands, especially in the colon. Kidneys pale, but healthy. Spleen small. Right lung adherent, and a small abscess over the liver in the lower lobe, partially hepatized, and corresponding to the liver. Heart healthy.

"Calvarium dense and heavy; over right parietal bone an apparent bulging, and over the middle suture thickened; the result of early injury. Membranes thickened, arachnoid opaque, with patches of lymph, the result of old inflammation. Convolutions flattened, grey substance pale and very defined, brain generally firm but anæmic. Brain small and atrophied. Base of skull rough, with prominences of bony deposit, some being very sharp."

Case 3.

"Gunner A. F., aged 26 years.

"Admitted into Colaba Asylum, Bombay, Feb. 22nd, 1845, after about two years' treatment in hospital for coup-de-soleil; during that time he complained of headache, ringing in the ears, loss of sleep, and delirium; this went on till Sept. 1844, when he became violent, and shouting continually. On admission he was suffering from low fever and diarrhœa. Imagined people were talking and speaking to him, and that they were trying to force air into his bowels. The usual treatment was pursued, and he was sent home, arriving in England in May 1846. He improved considerably on the voyage, but still had delusions; these, however, soon disappeared, and he was handed over to the care of his friends in the following month of June. Nothing more has been heard of him."

Case 4.

"Gunner R. M., aged 31 years.

"As far as can be learned, a sober steady soldier. Was admitted into Regimental Hospital July 25th, 1849, suffering from the usual symptoms of coup-de-soleil, from these he recovered and left; but was brought back in a few days from being found wandering about and talking incoherently; he gave sensible answers to questions, and there did not appear to be any suspicions as to drink. This went on, leaving the hospital for a short time, and being readmitted again, till he was sent to the Asylum at Fort William, and admitted there March 19th, 1851. He was treated with cold baths, purgatives, &c., and not improving was sent home to England and admitted to the Asylum at Hackney, April 30th, 1852, having sunk into a state of dementia, with general incoherence; he continued thus till he died from phthisis, on June 4th, 1856. Post-mortem revealed the calvarium very adherent to the membranes, the plates of the skull of unusual thickness, being at least ¼ of an inch, with the diploe filled up; the arachnoid contained about 2 ounces of serous fluid; pia mater, opaque and thick. The substance of the brain was firm, but appeared healthy. The brain was small. Lungs studded with tuberculous matter."

Case 5.

"Private J. F., aged 22 years.

"Believed to be a sober man. Was attacked with sunstroke, April 12th, 1852, and taken to hospital; he improved slightly under treatment, but gradually became much excited and subject to various delusions, imagining people were trying to kill him. On the 30th of April, 1853, he was admitted to the Lunatic Asylum, Madras, and after a short time sent home to England, arriving Sept. 14th, 1853, and admitted into the Asylum at Hackney; he was in a state of dementia and in weak bodily health; in the following January, viz. the 7th, he died from chronic dysentery. The result of post-mortem examination was as follows: calvarium dense; brain substance firm, and apparently healthy; membranes adherent, with about five ounces of serum within the arachnoid."

Case 6.

"Private J. T., aged 30 years.

"This man had an attack of coup-de-soleil in Bengal, in August 1857, after which his mind was disordered, and he appeared to be suffering from general paresis. On the 13th July, 1858, he was admitted into hospital, and found in a state of amentia; was transferred on July 21st, 1859, to the Lunatic Asylum, Madras, and sent home to England, arriving April 10th, 1859, suffering from general paresis. The disease ran the usual course, and he died July 17th, 1860, but no post-mortem appears to have been made."

Case 7.

"Private J. F., aged 30 years.

"A sober, steady man, had sunstroke at Moulmein in Oct. 1857, and was sent to hospital, where he was under treatment till Aug. 1858, and appeared to recover so as to be sent to duty. On the 9th January, 1859, he was again sent to hospital for irritability and strangeness of manner, refusing to do his duty, &c., and was then thought to be insane, though he did not appear to have any prominent delusions. Not improving,

he was, on the 2nd of March, 1860, sent to the Lunatic Asylum at Madras, and forwarded home to England, arriving on the 28th of June, 1860, and admitted into the Asylum at Hackney. He was suffering from chronic mania, and did not improve, dying on April 8th, 1861, from disease of the liver. Post-mortem examination:—The calvarium was thick, dense, and heavy; the diploe being obliterated. Dura mater thick, with opacity of the pia mater. The brain substance appeared firm; the grey matter varying from ¼ to ½ an inch in depth. The ventricles contained a small amount of fluid, and a large number of cysts were on the choroid plexis; the convolutions seemed natural."

Case 8.

"Gunner P. F., aged 29 years.

"Appears to have had sunstroke in 1859, and was admitted into hospital Nov. 12, suffering from cephalalgia. Complained of pain, principally at the occiput; he was strange in his manner as evinced by his dress, putting his belts on wrong, &c.; he improved for a few days, and then gradually became worse; but was kept under treatment till he was admitted into the Lunatic Asylum, Colaba, Bombay, on the 26th of August, 1860. He did not improve, and was sent home to England, arriving April 25th, 1861, and admitted into the Asylum at Hackney. He remained very silly, and on Sept. 16th, 1865, he was sent to his friends in Ireland, and nothing more has been heard of him."

Case 9.

"Seaman, T. T., aged 22 years.

"Had sunstroke on the voyage out to India, and on arrival there was found to be insane, so was sent home to England, arriving Aug. 8th, 1863, and was admitted to the Asylum at Hackney, suffering from mania. He gradually improved, and on Feb. 16th, 1864, was sent home to his friends, and nothing more has been heard of him."

Case 10.

"Private J. M., aged 27 years.

"Of sober habits and healthy constitution. Admitted into Depot Hospital at Benares suffering from acute symptoms, the result of coup-de-soleil. His brain was very active, and he suffered from violent delirium, requiring force to keep him quiet. After a few days this passed off, leaving him very low. His memory seemed affected, and although not violent, he was unmanageable and subject to occasional paroxysms of violence. There is no history of hereditary taint. Treated with cold affusions and tonics.

"Admitted into Fort William, Bhowanipore, Dec. 30th, 1858, suffering from sleeplessness, subject to despondency and paroxysms of violence. Treated by tonics. Sent home to England, and on ship's arrival in Sept. 1859, was so far recovered as to be allowed to go to his friends."

Case 11.

"Pensioner J. D., aged 40 years.

"Admitted into General Hospital, Sept. 1863, with the loss of the use of his right side after coup-de-soleil. From this he recovered and was discharged. After this he had a loss, and it appeared to prey on his mind, so that he was admitted into Bhowanipore Lunatic Asylum, Nov. 28th, 1863. Was violent and noisy, striking his head against the wall, attempting suicide; but after a short time he became quiet, and was sent to England, arriving April 26th, 1864, and admitted into the Asylum at Hackney, suffering from dementia and general paresis. The disease ran the usual course, and he died April 29th, 1867, but no post-mortem was held."

Case 12.

"Lieut. R. M., aged 26.

"Had sunstroke at Arrah, but no particulars were sent with him. He was of temperate habits, and was admitted into Bhowanipore Lunatic Asylum, Dec. 9th, 1864, labouring under various delusions of a personal character. Was noisy and

violent, imagining his relatives ought to be shot for cowardice. He was sent home, arriving in England Jan. 28th, 1865, and admitted into the Asylum at Hackney. He remained much the same, and was removed by his friends Jan. 29th, 1866."

CASE 13.

"Lieut. C. M., aged 40.

"Had sunstroke, followed by insanity. No history of his case. Still living."

CASE 14.

"Lieut. B., aged 36.

"No history; but was a sober, steady man, and became insane after sunstroke."

CASE 15.

"Lieut. B., age 39.

"The same."

CASE 16.

"R. L., aged 22 years.

"Was out in the sun, shooting one morning; after exposure to solar influence, he returned home and soon after became insensible, with stertorous breathing and convulsions. No medical man saw him, and he was sent to Kyouk Phyoo Aracan, Burmah, for treatment. He gradually became conscious, with loss of power in the lower extremities. His general health gradually improved, but with loss of speech and defective intelligence. He was sent to England, arrived Dec. 24th, 1878, and was admitted into the Asylum at Ealing, suffering from dementia. He had recovered the use of his limbs, but his mental power was weak. He has improved considerably, but lately tonic contractions of the extensor muscles of right arm have set in, so that I am led to think there is mischief connected with the centres relating to the arm. Still under treatment."

CASE 17.

"J. M., aged 43, and a widower, Surgeon-major, Madras.

"Was much affected at the loss of his wife, and while at Pulney, Madras, in the year 1868 had coup-de-soleil from

direct exposure, followed by headache on the left side, difficulty of articulation, and other signs of cerebral disturbance; this was followed by singing noises in the left ear, and defect of vision of the left eye from dilatation of the pupil, followed by great contraction. The memory became defective of recent events, and an eccentricity of conduct and manner became evident. Exaltation of ideas, great excitement, and a loss of control, was followed by excess of depression. He was placed under appropriate treatment, but the symptoms of violence and aberration increasing, as evidenced in striking those about him, and his wish to purchase property on a large scale, he was sent home, and came under my care at the Royal India Asylum, on August 25th, 1870, suffering apparently from general paresis. His ideas were exalted and bombastic, facies unhappy and perplexed; tongue tremulous and quickly receding, pulse varying from 76 to 93; temperature also from 96⅘ to 99⅘, gait unsteady and tripping. These symptoms continued till about August 1872, when there was a great improvement altogether; he became more rational and his walk more steady, so that he was enabled to leave the asylum, and resided for the following two years in Scotland. I saw him occasionally during this time; he lived temperately, and as far as I could learn had not shown any signs of venereal excess. He took interest in various things, and played golf, thus of course taking a large amount of exercise. On Nov. 5th, 1874, he was readmitted. At this time he is noted as suffering from the second stage of general paresis, very indistinct in speech, and labouring under extravagant and exalted delusions that he is to play a great part in India, that he is very rich, &c. &c. His pulse was small and quick, pupils strongly contracted, and temperature normal. Was treated with Ex. 1. Physostig. gr. ¼ three times daily. The symptoms gradually increased in intensity, and the paralysis became more marked till the beginning of December 1878, when he took to his bed. From this time I believe contraction of the lower extremities set in, and the limbs became strongly flexed towards the chin; he became rapidly worse, and died Jan. 27th, 1879, from exhaustion; he took food freely to within a few hours of his death.

"Post-mortem examination as regards the head only, was made about sixteen hours after death, and the following observations made:—Rigor mortis persistent; body much emaciated; calvarium strongly adherent, the plates dense; diploe obliterated; membranes very vascular, thickened, and adherent to the surface of the brain along the median fissure: this was found on separation to be caused by three or four bony plates, of the size of a sixpence, with small spiculæ passing into the surface of the brain on the left side; the brain was smaller than usual, and weighed only 44 ounces; the grey matter was deficient, and the convolutions flattened, and apparently not so numerous. Nothing unusual appeared in the substance of the brain beyond very slight softening in the right thalamus opticus.

"I think from the short notes of the above case, as I said before, great interest occurs from the close resemblance at the autopsy of the facts observed in the brother's case, plates of bone being there found as large as a shilling; the brother had never been in India, was not the subject of coup-de-soleil, and yet the disease ran somewhat the same course, but was of shorter duration. Venereal excess still may be to blame, but it must be remembered that he was well known as being a highly moral man, and did not mix in the society of those who would lead him into this form of dissipation."

"RE-EDUCATION OF THE ADULT BRAIN."

BY J. MORTIMER GRANVILLE, M.D.

THE very interesting and important case narrated by Professor Sharpey in the April number of 'BRAIN' recalls one that fell under my own observation rather more than twenty years ago. I will state its principal features, without going into details, and then venture to make the two cases an occasion for a few brief speculations which I am desirous of laying before medical-psychologists, with a view to obvious practical inferences in respect to the treatment of what I conceive to be a not uncommon cerebral condition.

In 1858 I was requested to see a daily governess and teacher of music, who had been suddenly attacked with what was thought to be acute mania. I found a spare, somewhat angular, eccentric-looking young woman, ætat. 26, in a state of great excitement, hysterical and choreic. Within a few hours —after a paroxysm of considerable violence, during which she talked and sang wildly and was with difficulty restrained by those around her—she fell into a state verging on suspended animation, which lasted a week. The skin was cold, and presented a dark mottled appearance; the pulse was scarcely perceptible at the wrist; the breathing slow and seldom deep; there seemed to be complete loss of consciousness, and scarcely any trace of sensibility. The muscles were cataleptic, and the extremities dropped slowly when raised. It was barely possible to feed the patient by the mouth, by holding forward the larynx and placing the fluid far back in the pharynx with a spoon, when it seemed to flow down the œsophagus as through a flaccid tube. This condition, which was treated with the interrupted current from the occiput and nape to the

hypogastrium, and mustard-poultices down the spine, subsided very gradually. Then came the state I am chiefly interested to note. There had clearly been an exciting cause for the attack in religious excitement, acting on a nervous system exhausted by protracted toil as a teacher.

When consciousness began to return, the latest sane ideas formed previous to the illness, mingled curiously with the new impressions received, as in the case of a person awakening slowly from a dream. When propped up with pillows in bed near the window, so that passers in the street could be seen, the patient described the moving objects as "trees walking;" and when asked where she saw these things, she invariably replied "in the other gospel." In short, her mental state was one in which the real and the ideal were not separable. Her recollections on recovery, and for some time afterwards, were indistinct, and, in regard to a large class of common topics which must have formed the staple material of thought up to the period of the attack, memory was blank. Special subjects of thought immediately anterior to the malady seemed to have saturated the mind so completely that the early impressions received after recovery commenced were imbued with them, while the cerebral record of penultimate brain work in the life before the morbid state was, as it were, obliterated. For example: although this young woman had supported herself by daily duty as a governess, she had no recollection of so simple a matter as the use of a writing implement. When a pen or pencil was placed in her hand, as it might be thrust between the fingers of a child, the act of grasping it was not excited, even reflexly: the touch or sight of the instrument awoke no association of ideas. The most perfect destruction of brain-tissue could not have more completely effaced the constructive effect of education and habit on the cerebral elements. This state lasted some weeks, and the "recollection" of what had been "forgotten," to use conventional terms, was slow and painful, needing, or, as I would now say, seeming to require, a process of re-education as distinct as (though, I judge, less prolonged than) that which proved necessary in the case detailed by Professor Sharpey. In the end recovery was mentally and physically satisfactory.

I cannot assume that anything in these two narratives will strike the practical psychologist as novel, or of even unfrequent occurrence. The clinical aspect of such cases has been sketched times without number. Nevertheless they present features of interest, as viewed from an etiological stand-point, which may be worthy more than a passing notice.

Either of three conditions may, I believe, be set up by brain disturbance, or disease, causing "loss of memory":—1, complete destruction of cerebral cells; 2, withering or blighting, which amounts to obliteration of the cells without destruction of their nuclei;[1] 3, a suspension of function without arrest of nutrition, as though a particular area of the cerebral organism were thrown out of the circuit of energy.

In the first event there will be final effacement of the records of ideation. So far as the cells destroyed are concerned, they and their properties are lost for ever. If the functions previously performed by these strata or tracts reappear, it must be because some other part of the brain has taken up the business vicariously—as I believe is possible with nearly every function or manifestation of mental energy. In the second event, when the cells are withered but the nuclei remain, a new crop of cells may spring from the parent organism, and after a lapse of time sufficient for development, the educationary record will reappear, the seed reproducing its kind, plus the effect of training and ideation. It may be that there will need to be so much re-education as to cultivate the new growth, and perhaps a re-impression of purely objective ideas, but it may, and probably in the majority of instances does, happen that the new cells will be developed with all the characteristics of the old. In the third event recovery may occur instantly, almost at any moment, if the obstacle to communication is overcome or breaks down in convalescence, so that the isolated, but scarcely injured, congeries of brain cells may again be energised. I speak of brain cells instead of "nerve-molecules," because, even accepting the vibration theory, it must be assumed that the vibrating particles are cellular vital organisms.

[1] I use the term *nucleus*, here and throughout in a non-physiological sense, simply to designate the seat of life in a cell, whatever that may be.

Supposing the states I have described to exist, I venture to suggest that the development of a new crop of cells from denuded germs or nuclei will account for the facility with which re-education, in cases like that described by Professor Sharpey, reproduces *knowledge*, even at a period of life when it is not easy to learn. What the new training and teaching does is not so much to impart information as to foster the growth of a new crop from the old seed, just as an after-crop may be procured by breaking up an over-stocked soil and applying the stimulus of manure. It is always possible that in the first process of instruction more seed may have been sown than germinated. Some good mental seed doubtless falls on barren ground, and it is perhaps due to the vitality and subsequent germination of this seed, ideas we do not seem to have cultivated deepen as the years go on.

Meanwhile I fancy it is as the progeny of old nuclei the physical bases of a revived memory are restored during general recovery in cases of the class before us. It seldom happens that the re-educating process needs to be very explicit or prolonged. Far less teaching than would have sufficed to implant the knowledge originally will cause it to reappear. In cases where the cells only are destroyed and their centres of vitality remain, it may even happen that the mere establishment of health will suffice to bring about complete restoration. When the new cells grow, the old memories will be revived. This is what takes place in ordinary cases, when, although no especial pains are taken to re-educate, the "lost" knowledge returns. The completeness of the recovery will probably depend on the vigour of the first growth, and is doubtless governed by the same law which determines permanence or tendency to revert to an old type in the propagation of recently impressed or acquired qualities of species or family. Ideas, or an organic tendency to form particular conceptions, are certainly transmitted from parent to child. The cells first developed in a fœtal cerebrum are probably imbued with the qualities and properties of the brains of the mother and father, in different proportions. The transmission of germs of mental character which slumber through one generation and awaken with all their ancestral energy in the next

is a recognised fact. It will therefore probably happen that the new crop does not at first present all the features of that which was blighted by disease, but develop part of its characteristics later on. Thus vigorous health at an advanced period of life will sometimes produce a perfecting of the recovery commenced, but not consummated, years before.

Cases of the first and third class are very likely to be confounded in practice. Final destruction may be assumed when perhaps, a tract has been isolated without being destroyed. In this way I venture to think hopeless dementia is occasionally diagnosed, when what has happened is the disconnection, or throwing out of the circuit of cerebral energy, of a particular tract or stratum of elements; and, unless watched, partial recovery, susceptible of treatment, may happen without being observed and helped at the critical moment.

Treatment for the first class of cases is valueless; for the second, the cure must consist in the reproduction of brain-cells, or rather, as I have suggested, the development of a new crop from the denuded nuclei of blighted cells. The so-called "re-education" is only in a limited and scarcely physiological sense educationary. It is a repetition of the training, not so much to teach as to stimulate the growth of new organic elements from pre-existent germs imbued with formative forces and characteristics which must themselves determine the physico-mental result. If new cells *are* produced they will be found already educated, that is, endowed with inherited characteristics which constitute the physical bases of memory. The educated germ naturally produces an educated cell. Upon this hypothesis rests the whole theory of heredity, species, and transmission.

In the third class of cases, recovery occurs as an accident of treatment, except when in the presence of a constitutional cachexia like syphilis, specific medication may remove the grip of disease which, so to say, holds the mental organism in fetters that its energy cannot act. It will, I think, be often found that the seemingly permanent losses of memory which occur after acute disease are due to the isolation of special strata of cerebral tissue by the stasis of syphilitic or gouty disease. Mercury, iodide of potassium, or colchicum,

may in this way serve as a "memory-powder," and work a cure.

The two points I am chiefly anxious to place on record, without any claim to novelty of suggestion are, first, that what is called re-education is often simply the fostering of a natural growth—never harmful unless overdone, but of less value than may at first sight be supposed—second, that, in the absence of special indications that what seems to be helpless dementia is actually what it seems, i.e. a physical destruction of brain-cells; it is always *possible* the patient may recover, and therefore never justifiable to write a case off as incurable, and leave it to drift unnoticed and unhelped.

ON AFFECTIONS OF SPEECH FROM DISEASE OF THE BRAIN.

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It will doubtless have struck all physicians as strange that Speechless patients should have such recurring utterances as jargon No. 1 (Vol. II. p. 205), or single words, No. 2 (Vol. II. p. 205), or, what is most striking, such as "I'm very well," "Come on to me," No. 3 (Vol. II. p. 208).

It may perhaps be well to give some examples of these several kinds of recurring utterances from Trousseau's admirable Lecture on Aphasia. (I take them from Bazire's translation for the New Sydenham Society, adopting his rendering into English of the utterances of real words from the French; some of the utterances were jargon.) One patient could utter nothing whatever else than "Oh! how annoying!" Trousseau says of this patient: "Although she looked intelligent and behaved like a sensible person, I could never obtain another word from her." Another patient uttered, "Vousi, vousi." Another at first could only utter "Monomentif"; later on a few monosyllables ended by "tif," or the first syllable of a word and "tif," instead of the second, as "montif," for monsieur. Another uttered "Pig, animal, stupid fool," and that alone. Another, "Nasi bousi, nasi bousi." Another, "My faith!" Another patient, "Cousisi, cousisi." (This patient, by the way, had the occasional utterance when very excited, "Sacon, sacon," which Trousseau supposed to be an abbreviation of "Sacré nom de Dieu.") Another, only "Oh! mad." Another, "Sacré nom de Dieu."

It will have occurred to the reader that these utterances are not in the same category as "yes" and "no," in regard to the hypothesis stated, Vol. II. p. 215. We cannot say that the cases in which they remain show a reduction to the most general of all propositions. Some of the utterances of group No. 3 are propositional in form, but yet not of use as propositions to the speechless man; they are to him not propositions at all; figuratively speaking, they are propositions intellectually dead; they serve only emotionally, and in that way subsidiarily, as a sort of articulatory material on which the voice may vary. "Yes" and "No," group No. 4, Vol. II. p. 209, also are occasionally from the mouth of the speechless man, intellectually dead (See No. 4 (*a*), Vol. II. p. 210), and serve only emotionally; nevertheless these utterances so serving are in a different category from those of group 3. We have even on this basis to ask, "How is it that some speechless patients retain an utterance of no propositional value to them, but one which to healthy people is a proposition of a *special* character, applying to a particular combination of circumstances, whilst other aphasics retain an utterance of no propositional value to them, but one which to healthy people is of propositional value of the most *general* character, applying to any combination of circumstances?" Of course (see Vol. II. p. 209) the utterance may be an elaborate (compound) interjection, as "Oh, my God!" but we prefer considering those utterances which in health are propositional.

The problem may be presented in one case. A patient has "yes" and "no," and has also some elaborate recurring utterance in propositional form. Supposing his "yes" and "no" to be utterable only emotionally (see No. 4 (*a*), Vol. II. p. 210), we may say that he has two intellectually dead propositions, one of a highly special kind, another of a very general kind.

We wish in this instalment to show that the retention of recurring utterances, other than "yes" and "no," although apparently is not really exceptional to the principle of Dissolution. In all cases of Dissolution there is supposed to be a reduction to the more automatic, more organised, to the earlier acquired of the processes, represented in the centres

affected. It is, I think, plain that this course is in some cases apparently irregular. There are conditions interfering with what we may designate the Simple Course of Dissolution.[1] Let me illustrate this by a case from another class of nervous affections. Just after a slight epileptic seizure there is Dissolution, which in this case is temporary loss of function of more or fewer of the highest of all nervous arrangements; the patient acts grotesquely; but his actions (occurring during energising of nervous arrangements next lower than those which have undergone Dissolution) are not always rangeable as being more organised, &c., than his usual doings; sometimes they are plainly largely determined by particular events happening just before the seizure—that is to say, there are conditions interfering.

The matter to be discussed is not of scientific importance as bearing on the Principle of Dissolution. The discussion will help us, I think, to clearer notions on the nature of Defects of Speech (our No. 1, see Vol. I. p. 314). Were recurring utterances alone in question it would not be worth a physician's while to consider them at much length. We shall in the next instalment consider other kinds of nervous disease in which we find phenomena analogous to the recurring utterances of speechless patients.

The following hypothesis is advanced, and for the present is applied to but one set of recurring utterances, the group No. 3, Vol. II. p. 208, and only to those of them which have

[1] The reader is asked again to observe that the term Dissolution is used, as it is by Herbert Spencer, for a process which is the reverse of Evolution. I am sometimes told that it is not a fit term to apply to the results of disease on the nervous system; granting that those results are the opposite of Evolution of the nervous system. I do not believe they can be shown to be the exact corresponding opposite. Even supposing that the term does not properly apply, I submit that it is inexpedient to coin another word for a process the reverse of Nervous Evolution, when Dissolution is already in use for the reverse of Evolution in general. Affections of speech are examples of Dissolution occurring in a subordinate cerebral centre. Insanity, as for example the case of post-epileptic insanity mentioned in the text, is Dissolution, beginning in the highest cerebral centres, in those centres which are supposed to re-represent all that the subordinate centres have already represented, and thus, indirectly, to represent the whole organism; the highest centres are the substitute of our highest, latest, ever changing mental states, the abstract name for which is consciousness, there being really a series of consciousnesses.

in healthy people propositional value. *Such recurring utterances as "Come on to me" were being said, or rather were about to be said, when the patient was taken ill.* Here we have, it is suggested, a condition interfering with the simple course of Dissolution.

In order that we may show this hypothesis to be reasonable, the reader must bear vividly in mind that "taken ill" means here the occurrence of damage in a region of but one half of the brain, the left usually, sufficiently extensive to cause loss of speech. He must keep in mind that the nervous arrangements in this cerebral region are *destroyed;* it will not do to think of the disease vaguely as something "disordering certain functions of the brain." And on the psychical side he must look on the condition as one of *loss of the words* used in speech. The expression loss of memory for words is too indefinite, or is only verbally definite. It is equally important for him to bear vividly in mind that the other half of the brain, the right usually, is not at all injured. He is asked never to lose sight of the fact that, although the patient is rendered Speechless by the disease, he is not thereby rendered Wordless. We must indeed bear most vividly in mind that *the patient has words remaining;* it will not do to think of this positive condition under the vague expression that "he retains a memory of words." If we do use such redundant expressions, we must be thorough in our application of them and say two things, (1) that the speechless patient *has lost the memory of the words serving in speech,* and (2) that *he has not lost the memory of words serving in other ways.* In healthy people every word is in duplicate. The "experiment" which disease brutally makes on man seems to me to demonstrate this; it takes one set of words away and leaves the other set. The speechless patient has *lost* that set of words which serves in speech; he *retains* another set of words serving in other ways;[1] he *retains*

[1] The use of such highly technical expressions as "memory," in "explanation" of complex symptomatic conditions, seemingly definite and authoritative, is largely to blame for our remaining with our ideas on nervous diseases out of focus. It is not always vividly realised that retention of memory of words can mean anything more than a retention of words, the word "memory" in that context being really surplusage. There is almost the idea that the speaker *gives* words to the persons spoken to; all the speaker does is to rouse words already

all the words of the (his) English language in so far as "receiving speech" of others goes; and for other purposes he has *lost* their duplicates by which he should speak. It is suggested that whilst the speechlessness answers to the damage in one half of the brain, the retention of other kinds of service of words answers to the fact that the other half is not damaged. Attention is also asked to the hypothesis already stated, and hereafter to be expounded at length, that every proposition in health occurring during activity of the left side of the brain is preceded by a revival of the words of it during activity of the right half.[1] This is stating the hypothesis roughly and inadequately; all that need be insisted on is that the unit of action of the nervous system is double the unit of its composition, and that, correspondingly, all mental action is dual; subjective followed by objective. But as roughly put the hypothesis will serve our present purpose, since the speechless patient has no left half of his brain so far as its use in words goes.

Here brief remarks may be made on dual action in other mental processes in order to make clear what is the nature of the dual service of words. If I do not succeed in showing that there is duality of mental operations and what is the nature of that duality, I shall fail to make clear my meaning as to the nature of Recurring Utterances and to interpret many other difficult parts of our subject. We take for illustrations Ideation and Perception; that is to say, "propositions of images," which are symbolised by propositions strictly so-called. This is truly a part of our subject. It is indeed an entirely arbitrary proceeding to separate the images symbo-

organised in the person spoken to. Any one will readily admit that the pain of a pin-prick is in himself, not in the pin; and every educated man admits that redness is in himself when he uses the ordinary language, "This brick is red." Why then should we speak of "retention of memory of words" by the aphasic when he understands what we say to him without, at any rate, using that expression as simply convertible with the expression that he retains words (physically organised nervous arrangements for words)? Whose words are those which occur in the so-called hearing "voices" of the insane?

[1] There are then, it is supposed, two services of words by the right half of the brain; the "reception" of words of others, and the reproduction of words which precede our own speech. These are the two ways other than speech in which words are supposed to serve. Doubtless at bottom these two are alike.

lised from the symbols of images; in what we shall call the "conflict" both are concerned. Nevertheless the artificial separation of them is convenient in brief exposition. It will suffice for illustration to take count of but one image, although two images must be concerned in every ideational or perceptive process and also in the stage preceding ideation or perception (ideation may not be followed by perception, but ideation must always precede perceptions).

It seems clear enough that the process which ends in ideation or perception is dual. *Before* we can see or think of a brick, before either ideation or perception can occur, that brick by actual presentation or by indirect presentation through association, must have roused an image in us. When we say we see a brick, all we mean is that we project into the environment, ideal or actual, the image which that brick has roused in us. This image arisen in us is the survival of the fittest image at the termination of a struggle which the presented brick has roused in us, is the end of the subjective stage; the further stage, or the second stage, is objective—it is referring the image already roused in us to the environment, actual or ideal. The brick is for us nothing more than what it has itself roused in us, so that, instead of using such figures as that "the mind impresses its own laws on sensations" we experience during contact with external objects, or "that the mind originates something additional to them," or "works them up into different shapes," or that it "impresses its own form on them," we should, I think, use the opposite figure that an external object acts on us and developes in us such as we are, *what it can*, we being at first passive and it active. I think it is plainly so in dreams excited by peripheral local excitations. And in reverse, cracks and marks in the burning coals make us see faces in the fire, rouse faces in us.

Returning to the dual service of words. If we coin the term *verbalising* to include the whole process of which speech is only the end or second half, we may say that there are in it two propositions: the Subject-proposition followed by the Object-proposition, the latter being called speech. Spencer writes ('Psychology,' vol. i. p. 162): "A psychological propo-

sition is necessarily compounded of two propositions, of which one concerns the subject and the other concerns the object; and cannot be expressed without the four terms which these two propositions imply." It is supposed that the subject-proposition is the "survival of the fittest" words in fittest relation during activity beginning in the right half of the brain, and that this survival is at once the end of the subjective and the beginning of the objective stage of verbalising. The subject-proposition symbolises an internal relation of two images, internal in the sense that each of them is related to all other images already organised in us, and thus it symbolises states of *us;* the object-proposition symbolises relation of these two images as for things in the environment, each of which images is related to all other images then organising from the environment; thus it stands for states of the environment; the two propositions together symbolise an internal relation of images in relation to an external relation of images. Thus the separation we have made into speech use of words and not-speech use of words may appear arbitrary; it is, however, convenient.

In one of the cases to be presently mentioned in the text—the patient who said "Come on to me"—there was *left* hemiplegia, and thus the inference is irresistible that his speechlessness was caused by damage in the right half of his brain. But as he was a left-handed man, his case is an exception proving the rule. It is admitted that there are cases of left hemiplegia with aphasia in persons who are not left-handed. Besides granting fully the significance of the fact that in the vastly greater number of cases loss of speech is caused by disease in the left half of the brain, the thing of infinitely greater significance is that damage in but *one* half can produce speechlessness; it is equally significant that damage in neither half, produces wordlessness.

In a few cases I can state the circumstances of the onset of the illness, which seem to me to countenance the hypothesis stated. The man whose recurring utterance was "Come on to me," and sometimes only "Come on," was a railway signalman, and was taken ill on the rails in front of his box. A woman in Guy's Hospital could only utter "Gee gee"; she

was taken ill whilst riding on a donkey. Dr. Russell of Birmingham has published the case of a clerk, who lost speech and became paralysed on one side, after hard work in *making a catalogue;* this poor fellow could only say, "List complete." Sir James Paget a few years ago had under his care in St. Bartholomew's Hospital a man whose left cerebral hemisphere was injured in a brawl. This man could only say, "I want protection."

The hypothesis further unfolded but applied only to the above-mentioned cases for the present, is that the words of the recurring utterance had been revived during activity of the right half of the brain, when the destruction of that part of the left half occurred which caused loss of speech, that they constituted the last proposition, or rather that stage of verbal revival (what we have called the subject-proposition), prior to the last proposition (the object-proposition). Ever after they were meaningless or, figuratively speaking, dead propositions, remaining utterances of which we can only say they were on one occasion speech; on that occasion fitted to indicate then occurring relations of things. On the rails, or certainly at some juncture, "Come on to me" *meant* "Come on to me," ever after the illness it meant nothing.

The expression "on one occasion" is not to be taken literally as meaning that; for example, the man who uttered "Come on to me" never said that before he was taken ill on the rails. The presumption is that he had said it on many occasions, when trains were approaching his post. What I mean rather is, speaking now of the healthy, that there is no such proposition in a man's mind, excepting when he is saying it. On the physical side we would suggest that the nervous arrangements concerned during the utterance of any such proposition are not excited, nor ready to be excited, in the particular order answering to such proposition except at the time of uttering it. Such propositions are new speech. The "same" proposition is new or "latest" speech each time it is uttered, if the words or syllables of it are not, so to speak, "kept ready made up" in that particular combination; at any rate it is "latest speech" when specially applied at a particular time to indicate then occurring relations of things which *are*

not fully organised; it is then, otherwise stated, a voluntary use of words.[1]

From the most automatic or "oldest" or "earliest" speech, applying to well-organised external relations of things up to newest speech, applying to now organising external relations, or otherwise put propositions now in the making, there are, it is supposed, on the physical side, only degrees of independency of organisation in the sense that the nervous centres concerned have lines of different degrees of resistance to currents of different force, entering the centres at different points. Other things equal, the more automatically serving (the more organised) nervous arrangements are lines of least resistance. There is, however, in the case of very frequently used and very automatic utterances, such as "Very well," "I don't know," a near approach to independent organisation, and in the case of the most common interjections a very near approach to it. Such utterances constitute what I call old speech, or, in the case of interjections, they are verbal processes lower and earlier than true speech—utterances not "now making," but nearly, if indeed not quite, "ready made up." And at the other extreme, in the highest, newest, or latest speech, there remains for a short time after the utterance a slight degree of independent organisation of the nervous arrangements concerned; did there not, we should not know what we had just said, and could not go on talking consecutively on any subject. If this reasoning be correct, such a

[1] The very same "utterance" which has *become* automatic by being often used for symbolising frequently presented, and therefore well organised, external relations of things would be once more a voluntary utterance, if it were used on a new occasion, that is for symbolising a relation of things not already organised, but only now organising. The "highest," "latest," or "newest," speech (the now organising or voluntary use of words), implies clear preconception; clear preconception is a necessary element for voluntary, as distinguished from automatic, operations; in voluntary speech the prior reproduction of words constitutes the preconception. If a man utters, as applying to a new set of circumstances, the most automatic utterance he has, or if he utters anything "for the sake of uttering it," as when asked to do so, there is then a voluntary utterance, for then the operation occurs after clear preconception. Disease shows this not to be a fanciful dictum. As we have seen, and we shall later on give further examples, a speechless patient may be unable to *say* (to repeat) what he has just uttered. We do not affirm that the word "say" in this context means a language process.

recurring utterance as "Come on to me" represents not only the last proposition *en permanence*, but is to be looked on as on the physical side, a keeping up of activity (of a greater readiness to discharge), of certain nervous arrangements, which normally exist only temporarily and only on special occasions, in particular combination, and which in health go quickly into subordinate function, and soon out of function.[1]

Such a recurring utterance as "Come on to me" was about to be new speech; the words remained *en permanence* as a dead proposition; a proposition stillborn. We can now describe the case of a man who has the two sets of recurring utterance as that of a patient retaining a new combination of words, and also an old combination—or rather in the latter two monosyllables, each of which is equivalent to a combination of words.

The reason for thinking that the recurring utterances under remark were and continued to be utterances occurring during activity of the *right* half of the brain, is that the left half of the brain is so extensively damaged that the patient cannot speak; he has no left half for their utterance. To say that the disease "caused" these utterances a positive condition is absurd, for the disease is destruction of nervous arrangements, and that could not cause a man to do something; it has enough to answer for in leaving him unable to speak. The utterances are effected during activity of nervous arrangements which have escaped injury. This remark may seem a truism here, but in more complicated cases it is very common to hear of positive symptoms being ascribed to negative lesions—to loss of function of nervous elements. (See p. 316, Vol. I., On Negative and Positive Elements in Symptomatic Conditions.) It is common at any rate for disease to be thought of vaguely as something "*disordering* the functions of the brain." In the cases we are now dealing with, and in cases of defect of speech, and also in cases of insanity, the function of some nervous arrangements *is lost or is defective.*

[1] Practically out of function, so far as our present subject is concerned, although, obviously, there would be no new acquirements possible, and no memory, if some nervous arrangements after their use did not remain lines of less resistance than before.

But it is an error to ascribe such positive symptoms as the recurring utterances in speechless men, the erroneous words uttered by those who have defect of speech, and the hallucinations, &c., of insane persons, to negative lesions—to loss or to defect of functions. These positive mental symptoms arise during activity of lower centres or lower nervous arrangements which have escaped injury, and are only to be thought of as symptoms in the sense of being the fittest psychical states arising during slightly hyper-normal discharges of lower or more organised nervous arrangements which are *then* highest, the normally highest having lost functions.

It might be suggested that not all, but only nearly all, the substrata of speech were destroyed, and that enough nervous arrangements remained in the left half for just one utterance. Since, as implied in a foregoing statement, I do not believe that words or syllables have nervous arrangements in the sense that there is one little nervous centre for each syllable or rather single articulation,[1] and for no other, and since too I believe that each unit of every nervous centre is the whole of that nervous centre in (different) miniature, I should be as ready as most people to accept this explanation. But a certain quantity of nervous arrangements, implying a certain quantity of energy, is required for every operation. As the Recurring Utterance is, as a series of articulations, very elaborate, and as the syllables are clearly enunciated at any time, it is not credible that slight remains of nervous arrangements can be concerned during the utterance of them, especially when looking at the matter on another side we see that these remains do not serve the patient to utter any other words whatever, except perhaps "yes" and "no," which I however believe to occur also during activity of the right half of the brain. The man who uttered "Come on to me" uttered it any time, with no effort, rapidly, and in fact just as well as a

[1] The reader will observe that nothing is said in the text which implies that a word *is* a nervous arrangement resenting an articulatory movement. All that is suggested (see Vol. I. pp. 305, 306) is that the *anatomical substratum* of a word is a nervous arrangement representing one or more particular articulatory movements. The reader will observe, too, that we sometimes speak of words, and at other times of their physical bases, but we do not, it is hoped, confuse the two different things.

healthy person could utter it; yet except for this and "yes" and "no," he could utter nothing else. It is submitted that it is not possible that such an utterance was effected during discharges of remains of a nervous centre so extensively diseased, that is to say, not during discharges of any part of a half of the brain which was damaged so much as to cause speechlessness. It is more likely to be uttered during activity of the undamaged half.

We repeat, the patient may have not only such a recurring utterance as "Come on to me," but he may have also the utterance "yes" or "no," or he may have both these words. We have endeavoured to explain the retention of "yes" and "no," p. 214, by saying that the patient is reduced to the two most automatic, the two most organised, of all propositions. We have tried to show that in a sense the principle of dissolution is not contradicted by the retention of the elaborate recurring utterances under remark. There are, we have suggested, conditions interfering with what we may call the simple course of dissolution. The patient retains not only his most automatic propositions, but his last proposition, the then most voluntary proposition; the former sometimes, the latter always, ceasing to be propositions.

Let us now look more particularly at the anatomico-physiological side; that is, examine the utterance from the side of degree of organisation of nervous arrangements. We must bear in mind that, to speak metaphorically, all disease cares about is degree of organisation; it respects processes the more they are organised, caring nothing about important or unimportant. At present we can only speak in outline.

In estimating organisation in its bearing on affections of speech or on any other sort of defects from nervous lesions, we have to consider recency of organisation, as well as degree of organisation. It is well known that in failing memory recent events are soon forgotten, whilst old events are remembered; but this is not without qualification; the *most* recent events are remembered as well as the old; on the physical side, nervous arrangements just discharged remain for a short time in a state of slight independent organisation, rivalling that of nervous arrangements discharged when the person was young

and vigorous, or that of nervous arrangements often discharged.

That the nervous arrangements for the words of the recurring utterance (No. 3) are parts of the patient is a truism; that the words must one time have been revived in propositional form, that certain nervous arrangements must one time have been discharged in a particular order, is another. The hypothesis that the words were being revived at the time when the patient was taken ill seems to me warrantable. As they remain always easily utterable, and they alone utterable, since the illness, it is plain that certain nervous arrangements which were being discharged when the patient was taken ill, or at any rate which were on some occasion being discharged in a particular definite order, remain permanently in a state of dischargeability far above normal. For the patient not only does not speak since his illness, but whenever since his illness he tries to speak, the recurring utterance comes out or nothing comes out. Note three equally important things—(1) he has it; (2) he has no other utterance (except perhaps "yes" and "no"); (3) he cannot get rid of it. It is certain that the nervous arrangements for the recurring utterance have somehow arrived at what is in effect a high degree of independence of organisation. We can say, if the hypothesis put forward be true, that the nervous arrangements for the proposition *just organising* at the time of the illness, those for the words last spoken or about to be spoken, remain as well as *the most and always organised* nervous arrangements for the most automatic propositions, and have somehow achieved a degree of independent organisation greater than that of any other word-processes except "yes" and "no"; probably by repeated utterance after their first utterance. On this matter we shall speak later, when considering the phenomenon called by Gairdiner "barrel-organism." At present the explanation given may seem to be merely a verbal one. We may consider part of the question at once. Repeating that the patient has the utterance, and that he cannot get rid of it, we restate the question thus. How is it, (1) that destruction of one centre (certain part of the left half of the brain) leaves in state of hypernormal dischargeability particular nervous arrangements discharging in another centre at the outset

of the illness, right half of brain, a lower centre? and (2) How is it that they do not go out of function, as they certainly would have done had not that destruction occurred? We say again that the destruction in the left half is not the cause of the recurring utterance; a negative state of nervous elements cannot possibly be the cause of positive nervous symptoms. Nor is destruction of some nervous arrangements the cause, or at any rate not the direct cause, of certain other nervous arrangements discharging and remaining in a state of hypernormal dischargeability. But plainly, if the man had not been "taken ill," he would not have had such a recurring utterance; he would have been able *not to utter it*, the nervous arrangements concerned would have gone out of function; but since his illness, he must utter it when he tries to speak, if he utters anything. I believe the solution of the seeming paradox to lie in this, that destruction of function of a higher centre is a removal of inhibition over a lower centre ('Principle of Loss of Control,' Anstie, Thompson Dickson), the lower[1] centre becomes more easily dischargeable, or popularly speaking "more excitable," and especially those parts of that centre which are in activity when control is removed. So to speak, these parts become autonomous, acting for themselves, just as parts of the spinal cord below a diseased point become autonomous in some cases of paraplegia. Thus the disease *causes* loss of speech; it *permits* the increased dischargeability of the right half. It is just as cutting the pneumogastric does not cause, but permits, increased frequency of cardiac beats. But, the simple course of dissolution being interfered with in the cases of speechlessness we are writing about, the activity of the centre manifests itself in the way it was temporarily in when control was removed. The greater excitability of a centre uncontrolled by removal of its higher centre is supposed to be temporary, but the particular activity may be kept up by repeated use; the speechless man's recurring utterance is being uttered very often; it keeps up what was doubtless at first a temporary organisation.

[1] Of course we do not mean geographically lower, but physiologically lower, more organic, &c., and, in some instances, the centre which acts before the one called higher.

We must be very careful how we use the word "cause" with regard to disease and symptoms. We must never speak of destructive lesions causing positive symptoms. It is erroneous, I submit, to say that any sort of disease causes elaborate positive mental symptoms—illusions, hallucinations, &c.—it causes a negative mental condition, the elaborate positive mental symptoms are *permitted*. Here again we see the crudity of the expression "disease disorders the function of the brain"; destructive lesions cause loss of function of some nervous arrangements, and thereby over-function of others is permitted. Another way of putting this is to say that the effects of Dissolution are not always, never I suppose, simply those of removal of the more special, voluntary, and least and latest organised, but are very often also a permitted increased activity of the next most special, voluntary, and next least organised. Thus in every case of insanity there *are* two diametrically opposite symptomatic mental states together, and there must be correspondingly the opposite physical conditions together.

In some cases there is the utterance of "yes" or "no," or of both, without any other recurring phrase. This would be explained on the supposition that the patient was not saying, nor about to say, anything when taken ill, and thus that there were no words being revived, no proposition organising, during activity of the right side of the brain. Thus there was, so to speak, nothing to interfere with the simple course of dissolution, reduction to the most automatic of all propositions.

It is to be clearly understood that in not one of the cases do I know what the patients were saying, or about to say, at the time of their attack. I must also mention that there are observations on record which perhaps run counter to the hypothesis. Thus a man, aged 21, suddenly called out to his mother, "Oh! I feel something extraordinary inside me." These were the last words he spoke, but his recurring utterances were "No" and "Mamma." Very likely, however, calling out to his mother, he would also have cried "Mamma."[1]

[1] I take this case from a lecture by Trousseau; the utterances were in French but I give them as translated by Bazire.

I must also declare that of other cases than those expressly mentioned, I know nothing at all of particular circumstances during the onset of the ailment, which could be supposed to have given rise to speech like the recurring utterances the patients had. I have no facts to bring forward to show what were the particular circumstances during the onset of the illness of the patients whose recurring utterances were severally "man," "one," "awful," "Yes, but you know," "I'm very well," &c. At first glance it seems unlikely that a patient should say, "I'm very well," at the time she was taken ill; but as a matter of fact, people becoming ill do make such remarks. Who has not heard a person say, when a little ill, or when a severe illness was beginning, "I'm all right, let me alone," perhaps adding the contradictory statement, "I shall be better directly"?

We must bear in mind that when people are not talking they may be speaking; for there is not only external, there is also internal, speech.[1]

Whilst thinking on anything, at least beyond the simplest, we are using words, and when thinking on anything complex, are speaking internally. But I do not see how we are to verify the hypothesis that a patient's recurring utterance was a survival *en permanence* of the words he was internally using,

[1] The reader will remember that the distinction into internal and external speech (only a difference of *degree*) is not (see p. 318, Vol. I.) that made into the two *kinds* of service of words—the subjective and objective. There are degrees of each kind. The subjective, at any rate in that part of it which is "receiving speech" of others, is plainly in degrees; we hear and "receive" what people are actually saying, we also remember what they have said, which is having again, faintly, the words in ourselves which their speech had revived strongly. It must never be forgotten that when we hear and understand what any one says to us, we can only do so because our own words are revived in us; if I have not the words "gold," "is," "yellow" organised in myself, it is of no use any one saying "gold is yellow" to me. Similarly the objective is in two degrees; there is both internal and external speech, corresponding to ideation and perception. Speech in *either* of these degrees is supposed to be preceded by an automatic and subconscious reproduction of words (by a subjective proposition), just as either "internal" perception (ideation) or "external" ideation (perception) is preceded by a subconscious and automatic reproduction of images. It is not meant that, either betwixt ideation and perception, or betwixt internal and external speech there are differences only in simple degree; the degrees are, I think, triply compound.

unless perhaps the circumstances and the condition of the patient are known very exactly.

We have to consider how the hypothesis applies to the recurring utterances, No. 1 and No. 2. How is it that there is (except perhaps "yes" and "no") jargon only, or but one word only? The difficulty is greatest with regard to the jargon (No. 1), and this I shall chiefly consider. I believe the jargon to be made up of fragments of the words or phrases the patient was about to utter when taken ill.

It is, I grant, a mere guess that a speechless woman, whose recurring utterance (I spell it from the sound) was "me," "me," "pittymy," "committymy," "lor," "deah," was saying, when she was taken ill, "Pity me," "Come, pity me," "Lord," "Dear"—that her recurring jargon-utterance represented what was part of the verbal revival prior to her last propositional or interjectional utterance, that it was a corruption of syllables of some of the words which were being revived during activity in the right half of her brain, when destruction in the left half produced loss of her speech. There is a greater difficulty in supposing that such a jargon-utterance as "yabby," resembling no English word, was made up of fragments of words which were being revived during activity of the right half of the brain, when the patient was taken ill. To say that "yabby" was a jumble of syllables of some words about to be uttered will appear to be carrying the hypothesis to its logical conclusion with more determination than caution.

Let us pause to remark on occasional temporary jargon, and on something approaching to it, in other aphasic cases. Some patients, who have only defect of speech, and whose erroneous utterances are nearly always real words, may occasionally utter "jargon," as "totano." I confess that I am unable to trace the steps of the formation of such jargon. Occasionally there is a very near approach to a transposition of syllables of a word. One of my patients said "gippin" for "pigeon." There is another kind of change: one of my patients said "lamb and crobster" for "crab and lobster." There is here a fusion of the first syllable of the second word with part of that of the first, or rather, perhaps, speaking of the physical side, a result of attempts at two articulations.

Such blunders occur, I think, in persons whose speech is only very slightly defective: I mean in those who, for the most part, speak well. The following occurred in healthy people: "mukes from Boodie's," for "books from Mudie's"; "get a cash chequed," for "get a cheque cashed." A similar thing occurs in writing, as "Mear Dadam," for "Dear Madam"; "pred budding" for "bread pudding." (This is interesting, as showing that expression by writing is really speech.) I believe that these troubles of speech are owing to hurry on the right half of the brain, to hurried reproduction of the words of the subject-proposition. Believing that images and words are subjectively revived in an order the reverse of that in which images and words are finally arranged, I suppose, speaking roughly, that the words of the subject-proposition "come over" to the left side prematurely. These utterances are jargon, the sources of which we can trace, in so far, I mean, as fusion of an initial syllable of a second word with that of a first word goes. And I believe this to result from hurried action in patients who have defect of speech, partly for the reason that such and similar mistakes occur when a patient replies at once to questions abruptly put to him, and because when not hurried, when not "taken suddenly," he may speak for the most part well.

We can now return to consider more easily the permanent recurring jargon of patients who are speechless. We speak of what is supposed to have occurred in the right half of the brain, when the speechless patient was uttering, or about to utter, his last proposition. If the reader does not go with me in supposing that the right half of the brain is concerned, he must, at any rate, believe it is some part other than that on the left which the disease destroyed. It is suggested that when the recurring utterance is in clear propositional form, such as "Come on to me," the right half of the brain was acting normally or usually; that when it is a single word or jargon, it was acting abnormally, being "hurried." What is the cause of this hurry? I believe it to be strong emotion. At the time of the onset of the illness, we may suppose strong emotion would be induced by the external circumstances, or much more probably by the setting in of the

illness, the patient being afraid of worse to come. Here, of course, a knowledge of the patient's temperament is very important. The patient who uttered "me," "me," "pittymy," "committymy," "lor," "deah," was, to my own observation, a most excitable woman. Her husband used to remark on this. He said she was fond of sensation tales: she would any time go out in the night to a fire. Strong, especially suddenly induced, emotion implies, on the physical side, great nervous excitation, that is to say, strong, wide, and sudden discharges; there will, under strong emotion, be more rapid and more numerous, and therefore conflicting, discharges of nervous centres. In the cases under remark we consider the result of discharges on centres for words.

The result of numerous sudden, strong, and therefore conflicting discharges, would of course be the survival of the fittest, but the survival amidst too numerous and too strong discharges would not be an elaborate and perfect proposition. We suggest that it would be but one word or a jumble of syllables of some words. Of course "fittest" here does not mean "the best," nor the fittest *for* the *external* circumstances of the time; it is the survival of the fittest under the *internal* circumstances.[1] The fittest words or syllables are the victorious

[1] The words and images which survive during healthy discharges are survivals of the fittest. So it is in disease. The images that survive in delirium are the then fittest, considering that some of the highest nervous arrangements are *hors de combat*. The delirious patient is not the same person as that patient before his delirium set in; the delirious patient is the sane man *minus* more or fewer of his highest nervous arrangements; his delirium is the fittest mentation then possible. In all cases it is supposed that what becomes conscious is what survives at the end of a conflict; the conflict is almost at zero in highly organised processes, such as those for recognising very simple and very often seen things; in these cases consciousness is almost at zero too. In movement of any part of the body there is not only co-operation, but antagonism also of muscles or muscular strands (Duchenne uses the expression "co-operation of antagonism"). The antagonist pulls—those against the direction of the displacement to be effected—may be symbolised as minus quantities; the pulls co-operating in that direction as plus quantities. A movement is then not the arithmetical sum of pulls of all the muscles engaged, but the algebraical sum of the pulls. Transferring these ideas to antagonistic and co-operating discharges of nervous centres, we may suppose that what we have called, both for health and disease, the survival of the fittest during a conflict of numerous nervous discharges is the algebraical sum of what on the physical side are co-operating and neutralising discharges during the conflict.

words or syllables which have survived during a conflict of very strong and sudden discharges beginning deeply in the nervous system, and ending, so far as we are now concerned, in that of many nervous arrangements for many words. Such survivals may be little fit or not fit at all to the then external circumstances; they express the emotions and ideas induced well or badly, as well as it can be done under the circumstances.

It is supposed that jargon is a survival of some of the syllables or articulations more or less fused during the sudden termination or arrest of a strong conflict of discharges of numerous nervous arrangements for different words. It is a popular doctrine that strong emotion leads to incoherent utterances, which, I suppose, means the survival of words symbolising more than one different set of ideas. Strong and suddenly induced emotion may lead to temporary speechlessness. We suppose that temporary speechlessness with great emotion betokens very numerous and strong nervous discharges, conflicting so as to balance or neutralise one another.[1] In some other cases of disease psychical states cease during sudden excessive discharges. An illustration is that during sudden and strong discharges, epileptic discharges, beginning in the very highest nervous arrangements (consciousness), the substrata of consciousness cease.

We now consider the recurring utterance of one word (No. 2, Vol. II. p. 205). Let us first note what occurs in health. Very often under strong and sudden emotion, a normal or usual degree of speech is not possible; some inferior speech is possible. When there is not incoherence, but one word may be uttered or rather exclaimed, as "fire!" "help!" the utterance is indeed often a very simple interjection, as "oh." One word, as "fire!" might in normal circumstances be propositional only or so practically; it might *mean* "there is a fire," but exclaimed under strong emotion it is also largely of interjectional value. Strong emotion leads to inferior speech, to

[1] Probably there is a more complex condition; during strong emotion, there are rapid and strong discharges on the vital organs which soon lead to exhaustion of these organs; thus there will be a multiplication of effects; the cerebrum, especially its highest centres, will be ill served with blood.

more automatic, more organised utterance. Figuratively speaking, emotion uses propositions in a largely interjectional manner, that is to say, it reduces them to or towards inferior speech. Emotion, as it were, still speaking figuratively, appropriates and subordinates an intellectual utterance. There is at any rate an interjection in the making, in the exclamation "fire!" "help!" &c., a degradation of speech (compare swearing). We see in the utterance itself, that with a fall in the intellectual element there is a rise in the emotional one. There may be an equal, no doubt a greater, liberation of energy during these utterances, but it is directed more strongly on the vocal (including respiratory) organs, to those organs which serve especially during emotions. Strong emotion tends to more automatic, inferior, utterance.

I suppose then that strong emotion, or rather, of course, the nervous discharges accompanying it, may have led in the becoming speechless man to so rapid a discharge of so many nervous arrangements of higher cerebral centres in this case for words, that in the great struggle resulting, the survival of the fittest was a survival, not of the best for the then external circumstances, but of but one word, or of some syllable or syllables; the fittest was then an interjection, or only some parts of sentences or parts of words fused into jargon.

Rapidity of emotion is the great thing in the above considerations. In another way we are concerned with rapidity—with rapidity of the being taken ill, which means rapidity of destruction of nervous arrangements in the left half of the brain.

In all cases of nervous disease we must endeavour to estimate most carefully the element of rapidity of lesions, not only the quantity of nervous elements destroyed, but the rapidity of their destruction. We have to try to estimate the Momentum of Lesions. We however use the term gravity of lesions. I do not pretend that I can show the bearing of the factor rapidity on symptomatic conditions in cases of Affections of Speech. It is fair, however, to consider it in this regard to suggest a basis for future investigation. The slowness with which a lesion comes on is determined by the slow onset of the symptomatic conditions; a small sudden hæmorrhage produces

greater but a more temporary effect, provided it does not at once kill, than a large, slowly developed softening. But in the latter the paralysis or other defect depending on mere destruction of the centre is more local and more lasting.

A very sudden grave lesion would render unavailing all external circumstances, and would prevent all emotion, for it would produce unconsciousness at once; a less grave one would prevent the influence of external circumstances, but would develope emotion. A lesion of very little gravity would allow external circumstances to act, but to act quietly and allow clear propositions to be framed. Repeating in effect what has been said, it does not follow that the lesion in the latter case is not an extensive one; the question we are now about is as to the gravity of lesions, metaphorically speaking *mv* of lesions.

We should then note whether the aphasia and hemiplegia are rapidly produced, whether or not there be sudden loss of consciousness, and note also the length of the coma, if there be any. Everybody does this for clinical purposes, in order to obtain empirical evidence of the kind of pathological process, whether it be clot softening, &c.; but we should use the facts also as regards the interpretation of the kind of recurring utterance the patient may have. Perhaps the bearing of rapidity of destruction on the nature of recurring utterances is not made evident in the above. It is not here *directly* a question of rapidity of destruction of any centre, or of "shocks" given to centres connected by fibres with the one suddenly damaged, but a question of the indirect effect of rapidity of destruction, of such destruction in so far as it is a *sudden removal of control* (or inhibition) over lower centres. Of course by "lower centre" we do not mean one geographically lower, but one anatomically and physiologically lower. The destruction can only directly *cause* negative symptoms; it neither directly causes the utterance nor interferes with it; it may be popularly said to cause it and to affect it indirectly, but it is better to say it permits it. In so far as cases of aphasia are concerned, the above is hypothetical. Let us consider the principle stated more generally. In other cases of nervous disease rapidity of dissolution is, I

think, evidently an important factor with regard to symptomatic conditions. The epileptic maniac is the most furious of all maniacs. Why most *furious?* The fury is the psychical side of what is physically of course great activity of nervous arrangements; it is activity of lower nervous arrangements; for as the furious maniac is insensible also, it is plain that his highest nervous arrangements are *hors de combat.* Why then are the lower nervous arrangements so active? I believe it to be because the process of dissolution effected in the epileptic paroxysm prior to the mania is the most rapid of all processes of dissolution—control is most rapidly removed. Let me try again to make this clear by formulating it otherwise. We have not only to consider "depth" of dissolution, but the rapidity with which the dissolution is effected—control removed. I believe we may say that the deeper the dissolution, the more general and more automatic are the processes remaining, and that the more rapid the dissolution, the more excitable are the nervous arrangements for those processes. So that with shallow and yet rapid dissolution the actions are elaborate and also busy; with deep and rapid dissolution, they are simple and also violent (it is not a question of "importance" of actions).

I presume then that the more rapid the destruction of the part in the left half of the brain, the more excitable would be the nervous arrangements in the corresponding undamaged right half, and thus that the activity of it would be greater—greater for some time after the onset of the illness. But the more rapid the destruction, the more quickly there would be loss of consciousness; thus the then external circumstance would be unable to act at all, and although the lower centre might be more excitable than usual, there would be nothing for it to manifest as a result of what was saying or doing at the onset of the illness.

To recapitulate. By considering (1) the external circumstances at the time of the being taken ill; (2) the intensity of the emotional state under which the last attempt at speech was made; and (3) the gravity of the lesion, we may perhaps be able to show why this or that kind of recurring utterance remains in particular cases of speechlessness.

We shall now consider phenomena analogous to recurring utterances in some cases of defect of speech (No. 1, Vol. I. p. 314), in order to widen the basis of investigation.

The patient who has defect of speech may get out a word, right or wrong, and go on uttering it; or he may even get out a proper reply, such as "very well," and go on uttering that in rejoinder to further questions to which it is irrelevant, being aware of that irrelevance. To use Gardiner's expression, who drew attention to this peculiarity, the patient gets the word or phrase "on his barrel-organ." It becomes a temporary recurring utterance; the permanent recurring utterance in loss of speech may be called permanent barrel-organism. In cases of defect of speech the patient may write a little, and then go on writing the same syllable or word or phrase over and over again. Here again is evidence, although indirect, of "barrel-organism" of words or syllables.

The following is a letter written by a patient who had defect of speech: it was not punctuated. He first wrote his address correctly, which for obvious reasons I do not give, I substitute "Hurst Row, North Newington Road" for it; the address recurs in the letter; the factitious address is put in place of it:—

"Dear Sir. I feel very well just now" ("for now" and "I feel" came next, but are crossed out) "for Hurst Row I feel very well just now for thingg in the first way for the thamk now. I know now I was in the first now in the first now in the Newington Road I keep you first way in Newington Road the poor way is the best way is the best way for me is the best way for me is the best way for me is the best way for me is the best way the way is the best for me for ways kept for me for kept ways kept me for way kept for me."

Here ends the letter. There is, however, plainly something more than barrel-organism in it.

From what would be generally called the physical sphere we obtain illustrations in some cases of *loss* of speech of "barrel-organism." If, after getting an aphasic to protrude his tongue, we ask him to put his hand on his head, he may, instead, open the mouth and perhaps put out the tongue. This, I grant, may be of doubtful interpretation.

Here let us note another peculiarity in cases of defect of speech, which, perhaps, can only be shown to concern us indirectly in regard to what has been said. It is a very important matter in the elucidation of the nature of defects of speech, and may properly be mentioned now in order to suggest inquiry if there be anything analogous in the recurring utterance in cases of loss of speech. In some cases of defect of speech we find that the patient who has uttered a word or phrase correctly, and who goes on re-uttering it as a reply, cannot repeat it when he is told and when he tries. He has said correctly, "I don't know." We tell him to say "I don't know;" he fails. Whether there is anything strictly analogous to this in the case of permanent barrel-organism Nos. 1, 2, and 3, as there is of "no," No. 4, will not be easy to determine. For if we ask the patient to *say* his elaborate recurring utterance, just as we ask patients who reply "no" to say that word, there is the difficulty that the recurring utterance comes out when they *try to* say anything; and thus its coming out may be not saying it, but simply uttering it as at any other time. I confess I have no personal observation on this matter worth mentioning. It has long been known that some aphasics at least cannot say parts of their recurring utterances. Thus a patient of Bazire's uttered "sapon, sapon," but could never say "sap" or "pon" only. Trousseau makes analogous observations. But here obviously there is a difficulty. What we call part of a word is really another word or syllable. A patient who consulted me for loss of speech learned to *say*—not merely to utter—"Battersea"; but she could not say "batter." When asked to say it, she said "Battersea."

Here we may make further remarks on dual mental action, taking this time not the process ending in ideation or perception, or both, but the process ending in voluntary, as distinguished from automatic actions. What we now say may serve to integrate remarks which necessarily came now and then incidentally in discussing different parts of our main topic. We make a few preliminary observations.

We must bear in mind that "will," "memory," and "emotion" are only the names men have invented for different

aspects of the ever present and yet always changing latest and highest mental states, which in this locality constitute what we call consciousness—consciousness being really a name for a series of varying and different consciousnesses. There is, however, a double series; subjective and regular consciousnesses. Each one of the series of object consciousness is secondary to a state of consciousness or subconsciousness, representing us altogether subject-consciousness. It is this duplication, I suppose, which gives us the feeling that we have a sort of general and persisting consciousness, and are also now, now, and now, conscious, this or that particular way, and which makes us say that this or that sensation or image comes *into* consciousness; or that we have a sensation and know that we have it.

Taking "will," "memory," and "emotion" to be real independent entities or faculties reminds one of the old woman's remark, "How lucky it was that Adam called all the animals by their right names."

To say a word or proposition when told, "for the sake of saying it," is not a language process at all. A speechless man's inability to say "no" when told (see Vol. II. p. 213) is a thing of the same order as his inability to protrude the tongue when told. The consideration of such facts will help us to classify the phenomena of cases of aphasia on a deeper basis than that of language. To use an expression somewhat loose in this connection, there is loss of certain voluntary actions in some cases of aphasia, with conservation of the more automatic—a dissolution affecting more than language processes, and affecting language processes not so much as language processes, but as they are some of the voluntary actions. We have to consider speech on this wider basis in order that we may be better able to see how speech is part of mind, and thus to get rid of the feeling that there is an abrupt and constant separation into mind *and* speech.

It is in considering the nature of these phenomena that we see, I think, the bearing of Spencer's remark on the distinction betwixt voluntary and involuntary operations. There we have to do with duality of mental processes. In the voluntary operation there is preconception; the operation is nascently

done before it is actually done; there is a "dream" of an operation as formerly doing before the operation; there is dual action. Before I put out my arm voluntarily I must have a "dream" of the hand as being already put out. So too, before I can *think* of now putting it out I must have a like "dream," for the difference betwixt thinking of now doing and now actually doing is, like the difference betwixt internal speech and external speech, only one of degree; in one there is slight discharge of a certain series of nervous arrangements, in the other strong discharge of that series. The "dream" must occur before I either think of now doing something, or before I actually do that thing, just as words must be reproduced in me before either I can say them to myself or aloud. To say that we know what we are going to do, or that we are intending to do this or that amounts to admitting the above hypothesis. These expressions imply our having a nascent excitation of nervous arrangements representing the parts formerly concerned in doing that which is now to be done again. If we say we are trying to do something, we mean similarly, and so we do if we say we remember how to do anything; there being no "faculty" of remembering an action apart from having the action (as it was formerly doing), again actual, although faintly actual, nascent. To "will," to "know," to "intend," to "try," to "remember," have each, in their several contexts above, the same meaning. They are different names for the subjective reproduction which precedes objective reproduction; they are names for "dreams" of what was once doing, and is now to be attempted again. Indeed the simple expressions, "He speaks," "He does so and so," imply the duality; imply objective activity following subjective activity. "He speaks," or "He does," implies a then temporary duplication of a person into subjective and objective; "he" represents that person's whole self of course, and "speaks" or "does," represents something doing by his whole self. "He" represents the whole of him in the stage we have figuratively called having a "dream" of a past operation, "speaks" or "does" represents the whole of him in the stage of imitating it. (We say figuratively, because we do not mean a visual dream, but having again sensations representing parts of the body dis-

placed, and as being moved thus or thus.) To take a simpler case, in speaking of which, however, usage will not allow application of the terms "voluntary" and "involuntary." "He has this sensation." Subjectively, there is a sensation arisen in him which associated directly with others, and by them indirectly with all others—all that have been organised. Objectively there is disassociation, the sensation is considered separately from all others that are organised and in relation to those now organising. We may fancifully put the duplication thus: "*He* has it," and "He has *it*;" thus artificially separating what is a rhythm of a subjective and objective state. When then we assert that a speechless man tries to say "no" and fails, we are tacitly affirming that he has the word "no" revived in himself, a "dream" of the word. He has the subjective word "no," but not the objective word "no," there being really two "noes," all words being in the duplicate of subjective and objective. So, were we to use popular language, and to say of a patient who "tries" to put out his tongue, and fails, or who tries to say "no," and fails, that he has lost part of his volition, we should only mean that he had lost not a part of some faculty, but the very objective actions themselves, their nervous arrangements being broken up; he has lost a part of himself. And were we to say that the patient desires to do those things, we should only mean that he retains the subjective actions, which in health are precedent, and are to him the preconception of the objective actions which cannot follow, for the simple reason that they do not exist. I suppose such expressions of duplication of mental states, "ideas *of* actions," "memory *of* words," "feeling, *a* sensation," and "*knowing that we have* this or that feeling," &c., imply that there is first and subconsciously the action, or the word, or the particular sensation associated with (because arisen out of), the already organised in our whole selves (subjective actions, words, &c.), before the second reproduction of them or rather of their duplicates in relation to what is then organising from the environment. A subjective word is first a centre of association with all other organised words, symbolising all other images, and afterwards a symbol of a particular image; an objective word is first a symbol of a thing, and next acquires

new associations with other words, then using along with it and similarly arisen to indicate new relations of things in the environment.

In healthy speech it is hard to see how we can have a proposition (either in the degree of internal or in that of external speech) before the words of that proposition have been subjectively revived. Otherwise how should we be more than machines? Words must have arisen in us in an order symbolising states arisen in us, before a proposition we utter can have *for us* any meaning as symbolising external relations of things one to another in the environment. To use popular language, we must first remember the words and then say them.

We do not, as already incidentally implied, mean that the parts of the subjective and of the objective process are arranged in the same order.

Let us return to the simple movement of the arm. The "dream" here begins of course with that which corresponds to what is the end of some operation which was actually done on some former occasion. If I am to put out my arm so far I must have a "dream," *beginning with* the hand being so far put out; and next of it as in varying positions up to that state of rest from which the movement really began when it was formerly done. If this were not so, we should not know what we were going to do; the end must come first subjectively, before the objective process can in any voluntary action begin, and can go on to that end. This implies that two different nervous units are engaged. One of the twins represents (*a*) incoming currents from skin stretched, muscles moving or balanced by antagonism from joints, &c., in the limb engaged, and (*b*) currents coming from the rest of the body, as being thus or thus fixed, or as thus or thus variously displaced during the particular local movement of the limb. And of course there is an accompanying series of outgoing currents, for if there were no motor element we should have no knowledge of the relations of the parts moved to one another and to the rest of the body; incoming currents would not suffice to give this relation any more than incoming currents from retired elements, without accompanying ocular movement, would

suffice to give us a knowledge of the relations of these elements one to another; and, plainly, unless retired elements are first known as out of one another, impression on them by objects would give us no notion of the exterior of those objects. Similarly, until we have already a knowledge of the relation of parts of the body one to another, we could not begin to make any movement of part of the body to operate on the environment. During discharge of this unit a psychical state of what was formerly doing arises. When the operation is to be repeated, to be done now voluntarily, the other unit discharges the operation, starting from an attitude of the body and passing on to the end of the operation by the limb. Manifestly this must begin by an attitude of the body, and the progress in the arm will be from the shoulder to the hand, in an opposite order to the "dream-movement." It is during the play of these two movements that what is called muscular sense arises. The psychical side of one process is part of what we call desire, of the other, of what we call effort.

That subjective states arise in an order the opposite of that they are arranged in in corresponding objective states is supported by the analogy of some dreams. A noise develops a dream, but, sometimes at least, the noise, which in reality acts on the sleeper first, is last in the dream it excites. In all dreams provoked by local excitations I suppose the transfigured excitation comes either last or later than the excitation itself. And I suppose that in such a proposition as "gold is yellow," the subjective order is the reverse of the sequent objective order; for our concern is first with the yellowness of gold, not with gold. This view is, I think, in harmony with what was said on transposition of syllables in mistakes of the slightly aphasic and the healthy. I believe there to be duality also in automatic operations; but in this case the movement has so often followed the dream that the two are nearly equally perfect and easy. The voluntary operation, the prior "dream," is imperfect, or, if perfect, the movement done after it does not imitate it closely; we try to do so, and fail. Becoming automatic by repetition is, on the physical side, for the two units to discharge more nearly together, because lines of less resistance are established; there is less delay betwixt

them, and thus preconception through the discharge of the first unit and less sense of effort during discharge of the second. Thus less and less consciousness attends processes the more they become automatic; subjective and objective actions become, as it were, nearly fused.

Let us now take other kinds of nervous affection which show something analogous to permanent barrel-organism of speechless patients. We wish to point out that there is evidence that operations going on at the time of unconsciousness supervening remain nascent or in abeyance—are not always swept away—during the unconsciousness. During the restoration to consciousness they become active again; on full restoration to consciousness, they cease.

Directly after or in coma from various causes, we occasionally see a reversion to actions doing when the comatising lesion occurred. An ostler coming round from coma, due to the kick of a horse he was grooming, began to "hiss," as grooms do when engaged in rubbing down horses (Brodie).[1]

Abercrombie writes: A lady, whose case has been communicated to me, was seized with an apoplectic attack while engaged at cards. The seizure took place on a Thursday evening, she lay in a state of stupor on Friday and Saturday, and recovered her consciousness rather suddenly on Sunday. The first words she then uttered were by asking, "What is trumps?"

I suppose the above instances show that actions nascent at the time when the illness occurred remained so during the coma, and went on again actively when consciousness was being restored; on full restoration to consciousness they ceased; the barrel-organism was temporary, because the highest nervous centres were only temporarily *hors de combat.*

The following case, kindly supplied to me by Dr. Buzzard,

[1] I suppose the following to be analogous, although consciousness was only partly restored: the action of laying the oilcloth had become "barrel-organic." A woman I was asked to see in a surgical ward of the London Hospital, who fractured her skull by a fall when laying down the oilcloth on a staircase, kept, during partial unconsciousness a few hours before death, manipulating the counterpane of her bed. We supposed this to be a continuance of the action of laying the oilcloth; the patient desisted for a time, at least when the nurse assured her "it was properly laid."

has never been published. It may be taken as a faithful record, since the observer's qualifications as a neuropathologist are of the very highest. It is one of extreme value in many ways.

"About fifteen years ago, a medical friend of mine, some 57 years of age, was pitched on to his head, owing to the horse which he was riding having put his foot in a drain. He was taken home in a state of profound insensibility, in which I found him very shortly afterwards. From the symptoms it was probable that he had fractured the base of his skull. For some hours (I have no note of the number) he lay in a state of deep coma, incapable of being aroused. From this his condition gradually changed to a state in which he appeared to sleep, but would reply 'Yes' or 'No' to questions put to him. He did not appear to notice anything about him, and never volunteered a remark, but scarcely ever failed to reply in the way described, and with such an amount of propriety that I remember it was difficult at first to believe that he was unconscious. Offered food, he would sit up in bed, drink it without a word, lie down again and go to sleep. On one occasion I wanted him to take a common black draught, but he appeared to resent this, said 'No! no!' fiercely, and turned away. By a little persistence, however, he was induced to swallow it. He would get out of bed, take the chamber utensil out of its place of concealment, and pass urine regardless of any one in the room.

"One morning, to my astonishment, he got up, walked to his shaving-glass at the window, and proceeded to lather his chin. He then shaved himself, with very fair completeness, and returned to bed. I happen to know that this was the way in which he invariably commenced his morning toilette, for he was a late riser, and he had frequently risen and shaved himself during my visit. From this day he got up every morning about the same time, repeated the operation of shaving, and then returned to bed. The action was performed with the same evident unconsciousness of the presence of others which we see in the somnambulist. Having returned to bed he would lie for the rest of the day in a dozing state, which was only interrupted by his taking food and passing his

evacuations, which actions were evidently performed in a purely automatic manner.

"Upwards of a fortnight from the time of his accident he woke up into consciousness, noticed persons in the room, and made some slight remark. Little by little during the next hour or two he began to converse at greater length, referred to circumstances relating to his business which had occurred before his injury, and it became presently evident that the time during which he had been in bed had left no trace upon his memory. Of the injury itself he knew nothing whatever, the last thing which he remembered being that he was riding on horseback.

"When asked the day of the week and month he unhesitatingly gave the date upon which (more than a fortnight previously) he had met with the injury, and became quite angry when assured that he was mistaken. The period of his illness had been cut out, as it were, of his life in the cleanest and most complete manner, and not a trace of it has ever since presented itself to his mind."

In the above-mentioned cases the patients recovered, and thus their cases are not closely analogous to our cases of permanent barrel-organ utterances in aphasia. A patient who recovers soon from aphasia loses his recurring utterance, becomes able not to utter it. These cases are analogous, and so is the temporary barrel-organism of some patients with defect of speech. In the permanent barrel-organism, or recurring utterances of patients who remain speechless, the restoration of the part (in the left half of the brain) placed *hors de combat* is impossible; it was destroyed altogether. The following case is more closely analogous to these cases than the above. Abercrombie relates (after Conolly): "A young clergyman, when on the point of being married, suffered an injury of the head by which his understanding was entirely and permanently deranged. He lived in this condition till the age of eighty, and to the last talked of nothing but his approaching wedding, and expressed impatience of the arrival of the happy day."

What does recovery in the case of the cures of barrel-organ actions mentioned mean? It means restoration to

functions of some or enough of the highest nervous arrangements; it means return of control. But in cases of speechlessness from entire destruction of nervous elements there can be no restoration; the control does not return. The recurring utterance remains, and by repetition becomes highly organised.

THE THERAPEUTIC VALUE OF CITRATE OF CAFFEIN AS A GENERAL SEDATIVE, ANODYNE, AND DIURETIC.

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CITRATE OF CAFFEIN, which exists in the form of silky prisms soluble in about sixty parts of water, has hitherto obtained a certain amount of recognition as an anodyne in varied cases of neuralgia. In hemicrania, tic-douloureux, dorso-intercostal neuralgia, and in some spasmodic affections such as asthma, it has occasionally been found of service; but beyond a passing admission of stimulating properties, its use has been for the most part empirical, and the drug, whether from the want of appreciation of the pathological causes surrounding the disease, or from the insufficiency of the dose usually prescribed, has been very generally regarded as of too doubtful efficacy for anything approaching universal recognition.

Elsewhere ('The Practitioner,' Jan. 1879) I have recorded my observations on the use of citrate of caffein as a diuretic in cardiac dropsy, and in doing so endeavoured to point out from a few selected cases the reasons which led me to its successful employment in a *class* of cases simulating one another in certain well-recognised pathological characteristics. Subsequent investigations have confirmed these observations in such an unmistakable manner that I may be pardoned the desire to enforce my conclusions, and at the same time to direct attention to the general therapeutic position of citrate of caffein as a sedative and anodyne in those conditions of mental anxiety and exhaustion, melancholia, sleeplessness,

morbid distress, asthenic mania, and neuralgia, where, as so frequently occurs, a similar train of pathological causes will be found (only developed in a slighter degree) as when a heart failing through pronounced adynamy or defective compensatory power, becomes associated with states, well defined, of arterial relaxation and passive venous engorgement.

In all cases of advanced cardiac adynamy with the physical signs of an embarrassed inco-ordinate cardiac muscle weakened from dilatation and overwork, there will in all probability be the associated condition of defective nerve nutrition. The restlessness and nervous anxiety, the chronometric derangement between respiration and cardiac impulse, the distressing wakefulness yet eager longing for repose only to be met by a turbulent cycle of ever-recurring thought, are indications of a brain morbidly nourished and lacking repose. The small flaccid pulse again, the want of harmony between the cardiac and arterial pulsations, the spasmodic urgent dyspnœa, and the localised or general anasarca may be the mechanical consequences of a heart dilated and wanting power, of an arterial system unbalanced, and of a venous system overloaded; but may they not also be the indications of a central and peripheral nervous system enfeebled and impoverished as well as venously congested from circulatory disorder? Vaso-motor paresis and diminution of blood-pressure will be admitted as prime factors in the train of symptoms enumerated, and with stimulation therefore of the cardiac ganglia, and stimulation of the motor nerves of the peripheral arterioles, we may do much in assisting to restore that equilibrium in the circulation which shall promote arterial fulness, remove effete material by the proper channels, and moreover afford such a fresh supply of nutrient blood to the heart, brain, and system as shall induce sleep and vigour of mind, the consequences of normal nutrition.

In advanced cases of cardiac disorder then where muscular embarrassment and neurosal inco-ordinate cardiac action, the indicators of progressive mural decay, have with their consequences to be met, citrate of caffein in doses of from gr. iij. to gr. v. may be looked to (1) to induce co-ordinate action of the heart, (2) to increase vascular pressure and

promote free and almost instantaneous diuresis, and (3) to stimulate a heart gradually being relieved of its source of embarrassment to more vigorous and forcible contraction. By these several means citrate of caffein is an important *aid* to the tonic action of digitalis; for without it, and unless the heart and circulation is relieved (either by diuretics establishing the necessary drain on the general circulation and indirectly staying the congestion of the renal veins in their connection with the inferior vena cava, or by drastic purgatives acting on the valveless portal circulation), tonic doses of digitalis will only make a further demand upon the embarrassed muscle to contract more forcibly on its overloaded chambers. With caffein however, on the other hand, as a diuretic of considerable power we hope to establish an outlet from the general system which, coincidently with more powerful cardiac contraction, shall relieve the stagnating pressure of venous blood on the right side of the heart; and by promoting equilibrium in the cardiac and general circulations, shall pave the way for the use of cardiac "tonics" as safe and efficient or even curative remedies.

For an explanation of the action of citrate of caffein upon the heart and vessels we must look mainly to the sympathetic system. The intrinsic cardiac ganglia endow the heart with that inherent power which enables us to account for the occurrence of palpitation of the heart notwithstanding the existence of adynamy and arterial relaxation, and notwithstanding the clinical fact that in many instances the pulse is no reliable indicator of the force, rapidity, power, or character of the cardiac action.

In the sympathetic system special to the heart itself, and in the cardiac plexus of the great sympathetic with its connecting media to the spinal ganglia and cord (the cervical sympathetic and cardiac nerves), we find, it must be remembered, a depressing as well as an accelerating power and not an accelerating power alone. The heart exhibits in itself the excitory ganglia (specially of Remak and Bidder) counterbalanced yet naturally uncontrolled by the inhibitory interauricular ganglion of Ludwig, and all these may severally be stimulated by sensory centripetal fibres taking origin in

the endocardium. Thus the heart has an inherent or dissociated power; and notwithstanding the existence of arterial relaxation there may nevertheless be palpitation adynamic and inco-ordinate, the result of reflex irritation commencing either in the viscera or also in the heart itself. The relation of the vascular system to the heart through the agency of the nervous system is of no less importance; the cord has an indirect influence upon the heart as acting upon the peripheral circulation, and according to the observations of Ludwig this influence is principally exercised upon the vascular supply of the abdominal viscera through the medium of the splanchnic nerve. But Cyon has still further shown that the change in the peripheral circulation, the result of a vaso-motor modification, may be a reflex phenomenon caused by excitation of a sensory nerve beginning in the heart. The "depressing nerve of the circulation" of Cyon represents in other words the centripetal origin of a reflex action, producing diminution of blood-pressure in general from paresis of the vaso-motor nerves, and depletion of the heart. The train of pathological conditions which we have been briefly considering may therefore be the result, or at least partially dependent upon, some irritating effect acting upon the substance of the heart itself. Clinical investigation will often speak of a heart dilated, adynamic, embarrassed, failing from useless work, with right side engorged with venous blood; and therapeutically we shall desire to stimulate the cardiac ganglia reflexly excited through pressure of blood on the endocardium to co-ordinate action, and, at the same time, whilst relieving a stagnating venous circulation, to increase vascular pressure, and to promote cardiac contraction through the medium of the peripheral and especially the splanchnic nerves. These are the effects which we have reason to think are induced in advanced cases of cardiac dropsy from progressive mural decay when the advent of free diuresis and a co-ordinate and more forcible cardiac action are amongst the clinical indications of the establishment of a more healthy circulation.

But there is something more resulting from the action of citrate of caffein in these cases of cardiac distress and dropsy beyond the mere establishment of diuresis and the stimulation

of the heart muscle. A patient in the severest distress, wakeful and disturbed with urgent dyspnœa and throbbing vessels, appears to pass the first quiet night with refreshing sleep under the influence of caffein. In the condition of insomnia associated with non-compensated valvular disease and progressive dilatation, there are it must be observed two conditions to be met by remedies for the production of sleep: (1) a disorder of the cerebral vascular system, resulting in arterial relaxation and venous congestion; and (2) a state of malnutrition or impoverishment of the cerebral cells, resulting in a morbid state of their activity. The venous engorgement is passive, and is a consequence of the atonic or obstructive lesion of the heart forbidding or preventing the onward flow of blood; but the state of arterial cerebral relaxation[1] (so often described as "dilatation," of which there is no clinical or pathological evidence) is, moreover, the result of a vaso-motor paresis of the intracranial blood-vessels, which more than probably invariably results when an overtaxed brain, approaching exhaustion, becomes in its clinical manifestations morbidly troubled and sensitive, and even in the later stages betokening the end—delusive, irritative, and full of wandering, illusory thoughts. The irritation and malnutrition of the cerebral cells in the second place is mainly dependent upon the want of elimination of nitrogenised waste, an inevitable result of the scanty secretion of urine and want of interchange of elements, and the form of sleeplessness closely simulates in its clinical manifestation that due to lithiasis; there is the same anxious desire for repose, but the cerebral activity forbids anything but a barren and irksome cycle of thought; there is no supply of fresh nutrient material, and the venous engorgement and state of arterial relaxation forbids the elimination of effete material. The free diuresis, therefore, which citrate of caffein insures, must be looked upon as one of the most important factors in the train of processes which it aids in establishing. The

[1] Niemeyer supports this view, for in speaking of cerebral hyperæmia he is careful to point out that "in non-compensated valvular disease of the left ventricle the whole amount of blood in the vessels of the brain and its membranes is not increased, since while the veins are overfilled the arteries are less full"; and he adds that capillary hyperæmia only results from "the overflowing of the veins obstructing the flow of blood from the capillaries."

brain partakes with the other organs of the body in recovering its normal state of vascularity and vascular equilibrium; effete matter is eliminated; and with the approach of the proper state of nutrition of the cerebral cells we may hope for the establishment of that normal physiological state of cerebral anæmia upon which refreshing sleep depends, and which cannot be attained so long as a state of vaso-motor paresis prevents anæmia as much as it prevents normal circulation and fulness of vessel.

These views as to the action of citrate of caffein in cases of cardiac dropsy of a certain type, lead almost imperceptibly to the explanation of the remaining cases in which caffein may be looked to to afford relief. That coffee in the form of strong decoction should have been recognised in medicine as an astringent in certain forms of diarrhœa is scarcely to be wondered at: it probably acts on the theory of stimulating the vaso-motor nerves, and so relieving the atony and consequent relaxation of the mucous membrane, allaying such forms of diarrhœa as may be deemed atonic, colliquative, sympathetic, or vaso-paralytic, as in cases of extreme cachexia. In asthma pure *café noir* has the recommendation of Dr. Hyde Salter; but according to the recent remarks of Dr. Thorowgood ('Lancet,' 1879), who speaks encouragingly of the use of citrate of caffein in doses of from one to four grains in the same disease, "its chief use is probably in protracted cases, where the nervous system appears to be worn out by the protracted state of spasm." In migraine, again, the citrate of caffein has been used with a certain degree of success. Like guarana, it may be looked to in some cases to ward off an attack if given sufficiently early; or in the later stages, when the nervous system is becoming exhausted, a patient who is a constant sufferer will often be able to tell the stage when a dose of a stimulant such as caffein will obliterate the lingering traces of the attack, and perhaps induce sleep. There is, in addition to this clinical evidence of the value of caffein, the observation of M. Hervey, that migraine is an arterial neurosis taking origin in the great sympathetic nerves, and its seat in the nervous filaments accompanying the arteries, the result being dilatation (or perhaps relaxation) of vessels. Collateral evidence indeed appears

to show that in a *class* of diseases associated with or dependent upon a vascular neurosis, with relaxation of vascular walls, citrate of caffein may be looked upon as remedial. It is only an anodyne, and its lasting effects as a sedative can only be expected, if associated with the "nerve storm" there is arterial relaxation and diminished cardiac energy as the prominent indications to be met.

With such pathological elements, we have a vast and important class of diseases in which we may obtain important results. In melancholia, in the brain of overworkers, in the sleeplessness and depression of spirits of drunkards, in poisoning by opium or aconite, and in such forms of acute mania as have been called by M. Gubler "asthenic," where a defect of incitation, an eye pale, and a pupil large, indicate excitants—in all these and allied cases we may reasonably hope that citrate of caffein, so readily given hypodermically, will find a permanent place. As regards the administration of the drug, it should be given in sufficient doses. Three grains of the citrate should be looked upon as the minimum dose; in cases associated with pain or asthenic mental excitement the dose will probably have to be increased and be frequently repeated; but in cases of heart disease, where it will serve as an adjuvant to digitalis, three to five grains given every night will usually be found sufficient to establish free diuresis, and induce that proper state of nutrition from which sleep, as not the least of the important ends to be attained, may be expected.

NOTES ON CERTAIN LESIONS OF THE NERVOUS TISSUES OF FREQUENT OCCURRENCE IN THE BRAIN OF THE INSANE.

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Morbid Affections of the Medullated Nerve-fibre.

A WELL-KNOWN lesion of frequent occurrence and of grave import in the brain and spinal cord of the insane has been termed Colloid degeneration, and its pathogenesis, as established by Dr. Batty Tuke and others, relegates it to the chapter of diseases of the connective framework, or neuroglia. I do not intend here to dispute this doctrine of its origin, but wish to direct attention to the fact of the frequent occurrence of certain morbid bodies in the brain and cord, which if not absolutely identical with the so-called colloid products, resemble them so closely that it appears impossible to discriminate betwixt the two; and yet the lesion to which I refer, far from being indicative of either a sclerosis or a degeneration of connective elements, is without doubt a product of morbid action in the medullated nerve-fibres. This lesion consists essentially in the presence of oval or spheroidal bodies, perfectly homogeneous in structure, clear, pellucid and colourless, devoid of concentric markings, but frequently exhibiting a tendency to marginal crenulation. These bodies vary in size, their long diameter being usually 13 μ. to 27 μ., but attaining in some positions a magnitude of 40 μ. They are unaffected by the iodine and sulphuric-acid test and most of the ordinary reagents. They resist carmine staining, but assume a light pinkish hue with hæmatoxylene dye. From the above description it will be seen that they may very readily be mistaken for what have been termed colloid bodies.

That they differ in many respects from the lesion designated miliary sclerosis is proved by the fact that they exhibit no reaction with nitric acid; that they are perfectly translucent, and cannot be seen by the naked eye under reflected light, as is the case with the nodules of miliary sclerosis; and lastly, though the size of the larger bodies and their crenulated margins give them a slight resemblance to the latter, they differ in being perfectly translucent, and never exhibit a fine fibrillated stroma. In every respect they most closely resemble those morbid products termed colloid bodies, and yet, if truly so, they must claim an origin wholly different from that usually assigned to these morbid formations. Their true pathogenesis is established upon the following ascertained facts:—

1. They vary in size in different regions of the cerebro-spinal centres.
2. Their distribution is limited to the region of the larger medullated nerve-fibre.
3. No structural analogy can be traced in any stage of their history between these bodies and the elements of the neuroglia.
4. Direct connection with medullated nerve-fibres is to be detected.

1. The variation in size is important to note, as it bears a direct relation to the varying diameters of the medullated nerve-fibres. In the medullary strands immediately beneath the cerebral cortex their diameter averages 13 μ., the largest very seldom reaching a magnitude of 27 μ. In a case which occurred at the West Riding Asylum, in which the onset of the attack was marked by acute delirium, intense cephalalgia, and other symptoms of meningitis, followed by symptoms indicative of a subacute cerebritis, with utter muscular prostration and a rapidly fatal termination, these bodies, supposed to be of recent origin, were found scattered in myriads through the white matter of the convolutions, all of them about 13 μ. in diameter, closely resembling colloid bodies, and yet, as will be shown farther on, distinctly from originating the nervous elements. When met with, on the other hand, in regions

possessing nerve-fibres of greater diameter, as in the medulla oblongata, they are found to vary greatly in size, the average dimensions being 27 μ., the larger bodies being fully 40 μ. in their longest diameter. This relation of their dimensions to the diameter of the medullated fibre is significant.

2. In all cases where these bodies presented themselves one very striking fact was noted—viz. the strict limitation of these morbid products to regions of the larger medullated fibre. Sections through the gyri invariably showed them to be scattered profusely through the medullated strands, advancing close up to the deepest or spindle layer of the cortex, where they terminate *abruptly* at the commencement or within the confines of this stratum. In the neighbourhood of the ganglionic layer, of the third or large pyramidal and of the second or small pyramidal layer, they were not met with. In the first layer of the cortex they are again often met with, but very definitely limited to its outermost zone, i.e. to the region of the peripheric strands of medullated nerve-fibres which are known to traverse this superficial portion of the first layer just beneath the pia mater. The fact of their limitation to the outer zone of the first layer and the lowest layer of the cortex, whilst the several intervening strata in which the non-medullated fibres predominate were wholly devoid of these formations, is also another feature strongly significant of their affinities.

3. In no case have I been able to detect any intermediate stage whereby they could be referred to morbid changes occurring in the nuclear and cellular elements of the neuroglia. There was usually no proliferation of perivascular or neuroglia elements, nor was there an increase observed in Deiter's corpuscle such as would indicate morbid changes occurring in the connective. Occasionally a nucleus appeared on the surface or border of these bodies, but it could always be regarded as extraneous to the morbid formation and accidentally superimposed. A connective origin has been claimed with much plausibility for the lesion known as miliary sclerosis, and these bodies have been stated to have been traced in all their stages from the swollen nucleus up to the perfectly characteristic form assumed by the patch of miliary sclerosis. In

face of the strong evidence adduced in support of this view I should hesitate to raise a dissentient voice, yet I must affirm that the strange limitation above noted is also recognisable in cases of multilocular miliary sclerosis which I possess. This fact I consider of sufficient significance to warn us fully to reconsider the pathogenesis of this obscure affection, and to study any relationships which they may possibly possess to the morbid products above referred to.

4. So far the evidence deduced, however strongly in favour of the origin of these bodies from medullated nerve-fibres, is of a purely presumptive character, and as such could scarcely be accepted as conclusive were it not for more direct evidence such as was afforded by the case above alluded to. Here these bodies, when carefully examined, were found to exhibit an almost invariable connection with a medullated fibre. Frequently the larger nerve-fibres were mapped out along their course by a series of such bodies forming lateral projections, compressing the axis cylinder or wholly obliterating it. In the smaller nerve-fibres the swelling involved occasionally the whole fibre, appearing like an aneurismal dilatation; the axis cylinder terminating abruptly at either extremity. Similar appearances to these were also presented by the lesions found in a case of glosso-labio-laryngeal paralysis. The fibres of origin of the hypoglossus arising from the nucleus near the floor of the fourth ventricle, as well as the decussating fibres of the raphe, being strewn along their whole course by great numbers of these morbid products, I therefore regard these morbid bodies as resulting from segmentation of the myeline ensheathing the axis cylinder, and trust I may in a future article be enabled to record the results of further researches into their pathogenesis. In the meantime the object of these remarks will have been fulfilled if they induce others to examine more closely these morbid products, which have been, I believe, too often relegated to the chapter of degenerations of the connective series.

Fuscous or Pigmentary Degeneration.

This degeneration of the nerve-cells of the brain and spinal cord is one of special interest to the pathologist, as it repre-

sents one of the most frequent of those retrogressive changes to which these nervous elements are subject. It is recognised as being generally associated with those morbid conditions which induce frequent and excessive engorgements of the vascular tracts of the cerebro-spinal system, and hence is seen in most cases of general paralysis, epileptic mania, and senile mania. The constant accompaniment of the fuscous degeneration, therefore, is the coarse and distended blood-vessel, the swollen perivascular sheath bulging irregularly along the course of the blood-vessel and obstructed by accumulations of leucocytes and deposits of hæmatoidin crystals. This lesion has been often described, as it presents itself in sections obtained from hardened chrome preparations, and it may not be amiss to describe here its features as presented in perfectly fresh sections of brain obtained on the freezing microtome. The nerve-cells of each individual layer of the cerebral cortex may be involved in this change, yet the lesion is best studied in those large nerve-cells found in the mid-cortical regions, especially of the motor area of the brain. These elements are in their *healthy state* often somewhat pigmented, although by no means so constantly and extensively as the multipolar cells in the anterior cornua of the cord. With the advent of degenerative changes, however, a notable alteration in the contour of the cell occurs. It becomes swollen, tumid, and eventually even spheroidal in contour, the invaded tract of protoplasm being usually at the base of the cell, but frequently found limited to the borders or the apex. The appearance of the degenerated portion varies in hue from a light fawn to a bright yellow or brownish-yellow, it has a roughly granular aspect, and is unaffected by ordinary staining reagents, contrasting therefore very strongly with the stained and uninvolved cell contents. Its progress, as exhibited by cells in various stages of degeneration, exhibits the following points of interest:—

a. Retraction of the unaffected protoplasm.
b. Displacement of the nucleus.
c. Sclerotic induration of the investing boundary.
d. Exposure of the *fibrous* structure of the cell.

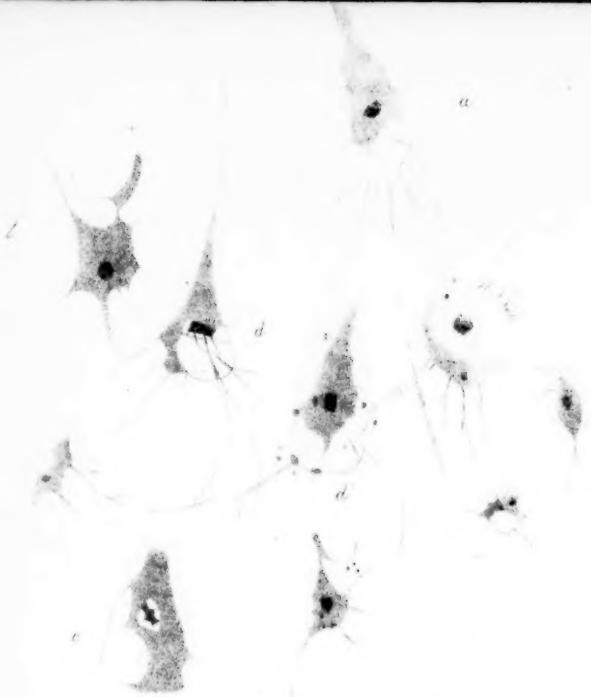

Fig. 1.
Illustrative of the Progress of Pigmentary Degeneration of the Ganglionic Cells in the Cortex of the Brain.
× 280

Fig. 2.
Nerve cells of the Third Layer of the Cortex Cerebri_Epileptic Idiotcy.
× 280.

In Fig. 1, *a*, we observe a cell which exhibits this retraction of its protoplasmic contents before the advance of the degenerated portion which is swollen by its imbibition of hæmatin.[1] This retraction gives rise to the appearance of bays (*c*) bounded by fibrous extensions from the unaffected protoplasm to the confines of the cell. At *b*, Fig. 1, a similar condition is observed, involving the summit of the cell. In all cases the nucleus retreats before the invading lesion, the cell presenting all the features suggestive of a morbid and excessive imbibition from without. Should the base of the cell be first involved, the nucleus will eventually be driven up towards the apex process—or towards the base, if the summit be first affected. If the degeneration takes its course from the side of the cell along its transverse axis, the nucleus will be compressed, and even flattened, against the opposite side of the cell. This eccentricity of the nucleus occurs in all cases, its exact position being ruled by the site of the pigmented mass. The cell wall surrounding the degenerated protoplasm becomes in advanced cases indurated and sharply defined, forming a dark irregular border, often much distorted, and presenting the appearance already described by Meynert and Lubimoff as a sclerosed swelling of the cell. With this thickening of the cell wall we often observe the presence of a sharply-defined cincture constricting the cell, and separating the pigmented from the unaffected protoplasm. The appearance, however, to which I would direct special attention is seen at an early stage of the disease, especially in sections obtained from frozen brain. It consists in the exposure of fibre-like continuations of the healthy protoplasm with the processes given off from the diseased area of the cell (Fig. 1, *a*, *d*). These processes pass through the degenerated mass, becoming lost in the retracted and healthier protoplasm. Such a condition I have now frequently observed, and I believe it lends strong confirmation to the views held by Beale and others, that the processes of these cells which apparently originate at the periphery really pass into the substance of the cell, and

[1] In the figures given illustrative of this morbid change of the nerve-cells the degenerated portion is left unshaded, the shaded portion being the healthier protoplasm stained by aniline.

emerge at a distant pole. The protoplasmic matrix in which these fibres are therefore imbedded is less resistant to the encroachment of the morbid change than are the nerve-fibres themselves. The protoplasm becomes pigmented and degenerated, and refuses to stain with the aniline dye, whilst the fibres remaining long unaffected become deeply stained of a bluish-black, and hence distinctly exposed to view. Eventually these fibres also become involved in the degenerative changes, their apparent origin from the cell boundary being marked by a thickened dark-stained nodule. In Fig. 1, *d*, I have represented an appearance not unusual in this disease, the processes where they leave the cell emerging from thickened rings in the cell wall. The persistence of the axis-cylinder process has, I believe, been noted by Mierzejewski, and I can fully endorse his opinion that this process is especially resistant to the degenerative inroads of this lesion. In cases of extreme senile atrophy this process has exhibited a remarkable immunity from degenerative changes, being readily traced, after acquiring its myeline investment, into the strands separating the columns of spindle cells; and yet the apex process would often be wholly absent, or terminate abruptly just above the cell in a linear series of coarse granules, which appeared to map out the former course of the fibre. Again; the diseased cell, whilst exhibiting its basal process intact, would often present itself as a swollen globular body, from the thickened periphery of which arose numerous extremely attenuated processes, terminating abruptly close to the cell, and giving it a peculiar spinous aspect. Vacuolation of the cell is by no means an infrequent accompaniment of these changes. Does the nucleus suffer during the march of these degenerative changes? Its frequent absence establishes the point of its ultimate destruction by the invading lesion, but the actual character of the change which it undergoes is somewhat obscure. We however frequently observe the appearance of oval or circular areas within its structure, which are paler than the surrounding deeply-stained portion, or at times wholly unaffected by the colouring reagent employed. Several of these colourless zones may be apparent in each nucleus, and they evidently indicate a change in constitution of the

nucleus. These degenerated portions do not assume the yellow pigmented aspect.

The Nerve Cells in Epileptic Idiocy.

Few opportunities have been afforded me of examining the brain of idiots at the West Riding Asylum, but those cases studied by the fresh method of preparation have all afforded most noteworthy and constant features. These are as follows :—

a. Spheroidal or pyriform contour of cells.
b. Marked eccentricity of nucleus.
c. Coarse granular contents of cells.
d. Pigmentation extreme, but not a constant accompaniment of the other features.
e. Great paucity of branches.

It was the second and third layers of the cortex which presented the above characters in a striking degree, the cells of other layers not differing so much from the normal condition except as regards their deficiency in number and extensive pigmentation. The cells of the second and third layers had all lost their usual pyramidal and irregularly angular form, and were universally spheroidal, slightly drawn out towards the apex process, which was invariably present, and deeply stained. Immediately at the junction of this process with the cell the nucleus was situated, and although occasionally the nucleus took a lateral or even basal position, this was very rarely the case, the terminal or apical position being an almost constant feature. The swollen cell could never be stained, except a very restricted zone of protoplasm which occasionally surrounded the nucleus or clung to the sides of the cell, in which latter case the cell had the appearance of clear translucent contents surrounded by a dark thickened border. As to the unstained contents of the cell, they were *usually* of a bright yellow tint, but occasionally colourless and translucent. The contents were coarsely granular, and with high powers were resolved into oval or spheroidal bodies, varying in diameter from 2 μ. to 4 μ., highly translucent, and, as above stated, either colourless or of a bright yellow tint. The whole

cell was closely packed with these granules from the apical to the basal extremity of the cell. It was always observed that when these granules were colourless, intervening fragments of protoplasm occurred, forming stained boundaries betwixt the granules. In a few exceptional instances the cell was more elongated in contour, the nucleus basal in its position, and healthy-stained protoplasm was found beneath the apex process—nucleus and protoplasm being apparently forced asunder by the new material intervening. The deficiency of cell processes was a most striking character in all these cases of idiocy. Most of the cells exhibited the apex process only; others showed one or two secondary branches; but very few possessed so many as four branches, and these were remarkably fine and attenuated. The appearance presented by these cells, magnified 315 diameters, is represented in the accompanying plate.

ON THE BALANCE OF PRESSURE WITHIN THE SKULL.

BY JAMES CAPPIE, M.D.

It being admitted that the brain is the organ through which mental acts or states are more immediately produced or revealed, the working condition of the former becomes the correlative of the existence of sensation, memory, thought, and volition. The working condition of the brain depends on a certain standard of structure, and a certain relation to the circulation and to other structures and agents. The more that structure and these various relationships are understood, the better qualified shall we be to trace how far any given mental act or state is related to any special sphere or mode of activity in the nervous centre, and *vice versâ*.

In studying the causation of mental phenomena we need not be deterred by the fact that our knowledge, at the best, is likely to be always remote. It may not be the less positive so far as it may pretend to go. We must ever be content to accept the fact of consciousness as ultimate. The physiologist will never be able to perceive why the brain's activity should be associated with its manifestations. Yet, if a correlation be assumed, he may be able to determine why one form of consciousness rather than another is present; why it is present with a felt amount of intensity; or why in certain circumstances it is obscured or suspended. The nexus between molecular activity of brain and activity of thought and volition may for ever remain "unthinkable," but many of the modifying conditions of the molecular activity may certainly be determined, and the remote but necessary influence of these on the mode and intensity of mental action may thus to some extent be recognised.

In the present essay I wish to give prominence to some of the more general conditions in which the brain is placed—to trace a relation between the organs' mode of working and certain peculiarities in its physical surroundings. I shall have no experiments to detail, nor anything new to reveal in regard to structure. I shall simply apply well-understood principles in physics toward explaining some facts in encephalic physiology, and shall have to depend for the correctness of conclusions on the appositeness of the analogies adduced, and the coherence of my argument. I am aware that in these days of physiological laboratories, when every inference has to be tested by an appeal to the senses, such a plan may not be allowed a high place in the methods of exact science. But in addition to the fact that it is only to a limited extent the general practitioner can avail himself of the more exact instruments of research and experiment to advance physiology, it is possible that some subjects may, at least up to a certain point, be quite successfully treated by broad views being taken of general relationships. In every phenomenon there is of necessity a chain of causation, but the revelations of minute analysis are too frequently only isolated links. These furnish interesting facts rather than explanations. No analysis of sea water would ever enable us to explain the ebb and flow of the tides. It may be, therefore, that by holding some vital phenomena at arm's length, and taking a bird's-eye view of palpable relations, the order of combination and sequence which constitutes causation may be recognised more readily than by atomic or microscopic analysis of the instruments concerned in their production.

It is becoming trite to remark that in the development and activity of everything living, its "environment," "surroundings," or "medium" has an influence only second in importance to that of special structure.

The physiological bearing of the brain's surroundings does not seem to have received the attention it deserves. The skull has been regarded simply as an organ of protection, and less importance is now attached to the peculiarities of the encephalic circulation than was the case many years ago.

Restricting ourselves in the meantime to the skull, much

has been written to show how well adapted its structure is to serve as an organ of protection. By its form, and by the firmness and elasticity of its walls, it combines moderate weight with great power of resistance, and thus, while not a burden to the individual, it secures the delicate structure of the brain against physical injuries.

It is more than probable, however, that the mechanical properties of the skull must have an important effect in influencing the physiological action of the brain itself. If its osseous walls are efficient in affording resistance to agents from without, they will no less exert *repression* on the forces operating within its cavity. The fact that there is a rigid limit to the brain's expansion cannot be without significance.

That in certain circumstances there is a decided tendency to expansion of the brain is well known. When it has been so exposed from injury of the skull that its behaviour can be observed, it has always been noticed that while during sleep the organ tends to sink or retire from the inner surface of the skull, in wakefulness it expands, and not only fills the whole cavity, but it may protrude beyond the aperture. Some forces are at work in the latter state which are quiescent or less powerful in the former. The tendency of these is to make the brain increase in bulk. If its rigid envelopes were suddenly to give way when, for example, severe muscular efforts are being made, the momentum of the blood would cause the vessels to be more completely filled, and the organ would instantly expand beyond the bulk it could possibly occupy while they were entire. To any tendency of this sort, however, the walls of the skull oppose an effectual barrier.

Assuming, then, that when the brain is active its function is exerted under a state of physical repression or stress, we have to consider how such a circumstance may operate in modifying the results of activity.

In physics we have abundant examples of the behaviour of energy under a state of repression. Its tendency is to explosion; or, if liberated in a special direction, to produce intensity of discharge. The utility of the steam-engine, the rifle, and the electric telegraph depends on our being able to control the liberation of certain forces under stress.

From the analogy of physics, then, we may reasonably suppose that whatever energy the brain is able to produce or liberate, it must be more concentrated and sustained, more readily or more completely directed into some special channel, than if it were diffused in all directions in its very production. Or, if we look at the mental correlatives, we may infer that sensation and perception are more exact and acute; thought more coherently sustained; efforts to produce muscular movements stronger and more accurately directed, on account of the physical restraint to which the organic substratum is subjected.

Of course if the brain as a whole requires some counterpoise or fulcrum to insure a required intensity in the discharge of its energy, the same law must apply to individual portions of the brain. Each local or limited area of ganglionic structure which may have specific duties to perform must receive a background of resistance or support from other structures, and increase or failure of this support will have a modifying effect on the result.

It becomes at once obvious, then, that a knowledge of the sources of internal pressure, and of the conditions by which it is modified, is necessary to enable us to understand an important department of encephalic physiology.

The immediate sources of pressure will be similar to those in other parts of the body. There is, in the first place, the expansive pressure of simple growth. When the molecular elements are multiplying or developing into structures more cellular, they attract, with more or less energy, materials from the neighbouring blood-vessels; and in assimilating these an actively expansive force is brought into play, the aggregate amount of which will depend on the rapidity of the process, and the area over which it extends. It is no part of our plan, however, to take cognizance of the intracranial pressure produced from this cause, although, especially in diseased conditions, its consideration is at times of the highest importance.

The second and, so far as the present inquiry is concerned, more important source of pressure is the movement of fluids. We assume that the mechanical force so exerted is in accordance with the ordinary laws of physics. The greater the bulk

and the more rapid the movement, the stronger will be the pressure. Applied to the circulation within the skull, this principle will be equally true in regard to individual vessels or to clusters of vessels.

From this restricted point of view as to the origin of intracranial pressure, its balance will depend simply on local alterations in the distribution of blood through the vessels. Every change in its circulation will be accompanied by a change of pressure in or on the brain.

Our next object, then, must be to determine on what conditions any alteration in the intracranial circulation may depend.

The principal factors concerned in the supply and distribution of blood through the brain are—1, the action of the heart on the general circulation; 2, the action of the vaso-motor nerves on any of the branches of the circle of Willis; 3, the molecular movement in the brain tissue; and 4, the pressure of the atmosphere opposing the flow of blood from the venous sinuses.

In considering on which of these conditions local alterations within the skull occur, the action of the heart may be kept out of view. The ratio of that action will be the same to the whole cavity, and any change of impulse will equally affect all the vessels. Local modifications must be caused by local conditions.

The conditions which will most immediately affect the local distribution of blood are the calibre of the feeding vessels and the activity of the molecular movements. So much sympathy exists between these that they should be considered together. They are so intimately joined that it is impossible to say where causative influence begins or ends. If any distinction, however, is to be made, then greater importance must be attached to the agitation of the molecules. Nothing definite is known as to the action of the vaso-motor nerves on the arteries within the skull. The result of experiments has been negative or contradictory.[1] But we can conceive of the movements of the tissue-molecules acting on the circulation in

[1] See 'Physiology and Pathology of the Sympathetic System of Nerves.' By Drs. Eulenburg and Guttmann. Translated by Dr. Napier, 'Journal of Mental Science,' July 1878.

various ways. Their agitation may communicate its infinitely rapid waves directly to the blood; or the reaction between the blood and the tissue may so modify the attraction of the former for the capillary walls, that the sphere of greatest activity in reaction constitutes the "line of least resistance" along which fluids under pressure must of necessity tend to move; or the molecular agitation may affect the afferent nerve of a vessel—controlling ganglion, which again transmits an influence to the small vessels. It is more likely that any or all of these modes are correct than that any ganglion by itself should have some intuitive perception of the wants of the tissue. Practically, therefore, at all events in the normal state, we may also leave the action of the vaso-motor nerves out of view, and restrict ourselves to the influence which the molecular movement itself possesses of modifying the circulating current.

From the biological point of view, then, the molecular movement in the brain tissue and the movement of blood in the capillaries cannot be separated. Anatomically, such a separation is difficult; physiologically, it is impossible. As an organ which produces and discharges energy, the brain is as much dependent on its supply of blood as the burning fuel is dependent on a current of air: and, again, the flow of blood in the capillaries depends as much on activity in the molecules, as the draught of air through the burning fuel depends on the act of combustion. Check the blood-current, and the agitation of the molecules, with the function involved in their activity, is at once suspended or modified; stimulate the molecular movement, and the blood is transmitted with greater energy. The physiology which would ignore this reciprocal action takes a retrograde step of at least half a century. Even as a "working hypothesis" no amount of precision in describing changes in the histological elements of tissue would ever make up for its loss.

In regard to the influence of the atmospheric pressure in modifying the encephalic circulation, that I consider to be one of very great importance.[1] It results from the physical

[1] See 'On the Relation of the Cranial Contents to the Pressure of the Atmosphere,' 'Edin. Med. Journal,' Aug. 1874.

qualities of the cranium, which only permit the contents of the cavity to be affected through the blood-vessels which enter or leave the bony walls. It tends to oppose the exit of blood from the venous sinuses, and the backward pressure so occasioned will, of course, be exerted on the internal surface of the venous vessels through their whole extent. It will thus assist in preventing the block in the entire encephalic circulation that would be caused if the arterial impulse were to press the brain directly against the dura mater. The immediate physical result, as we shall afterwards more fully explain, will depend on the support the vessels receive on their external surface. If the forces causing brain-expansion be relaxed, the veins will be distended; and thus a certain amount of tension is at all times sustained in the brain tissue. On the other hand, if the brain tends to expand, some room is gained by the veins being compressed and their contents lessened.

Assuming, then, that molecular agitation is the dominant factor in modifying the movement of blood—that its intensity and sphere condition the rapidity and direction of the circulation, we are in a position to discuss some details as to the balance of pressure within the skull.

When the brain from a condition of rest, as in sleep, is roused to activity, the immediate effects are to increase the agitation in the molecular structures and to cause more rapid blood movement. This, of course, involves increased pressure within the capillaries, and the result, as we have already seen, is to cause an expansive tendency in the brain itself. To this tendency two important checks are opposed. These are, in the first place, the rigid limits presented by the cranial walls, and to which we need not further allude. The second check is the peculiar structure of the pia mater.

This membrane presents a curious interlacement of arterial and venous vessels, the physiological meaning of which has not received the attention it deserves. Its connections with the brain are entirely capillary. The large mass of the brain is fed by arteries which from the first penetrate its substance in a state of capillary minuteness; the veins also leave the nerve tissue as capillaries, and in the pia mater they coalesce to form large tortuous vessels. Now, if expansion of the brain

were to occur beyond a very limited extent, a process of self-strangulation would take place. The circulation itself would be stopped. The first effect must be to compress the veins, but this compression cannot be to a greater extent than will allow whatever amount of arterial blood which enters the skull to be transmitted onwards. The result will be to increase the tension in the brain itself. The blood pressure will be expended in rapid movement.

To this tension all the fluids and solids within the skull will be alike subjected. It will not be greater at one point than at another. The area being limited and full, and so much of the contents being fluid, the important law of pressure being transmitted equally in all directions will here hold good.

A moment's consideration will enable us to perceive how such a fact is to be reconciled with the statement previously made, that every change in the intracranial circulation involves a change of pressure in or on the brain. We have simply to bear in mind the distinction to be made between active pressure and "stress,"[1] or tension.

In a glass globe where gold fish are in active motion, the currents or agitation in the water can never so affect the globe itself as to make it tend to move in one direction or another. If it were fixed on wheels on a smooth table, "even were the table a lake of ice and the wheels extremely delicate, we should find that the globe would remain at rest."[2] Whether the currents in the water be strong or weak, the pressure on the sides of the vessel will be equalised through its whole circumference. Throughout any particular level the amount of stress will be the same. But within the area of uniform stress, the disposition of movable bodies or particles will depend on the rapidity and direction of the currents, and thus, in the case before us, the movement and position of the fish may vary every moment.

So, within the skull, whether stress be stronger or weaker, it must be equalised throughout the cavity; but the direction

[1] "The word 'stress' as an equivalent for 'action and reaction,' and as a generic name for pressure, tension, &c., will save future generations a great deal of trouble."—Prof. Clerk Maxwell, 'Nature,' Aug. 20, 1874.

[2] Prof. Balfour Stewart, 'Conservation of Energy,' p. 9.

of the blood currents, and therefore the disposition of the movable solids, will be subject to infinite variation, and there will be no end to the modes in which the action of the brain itself may be modified from this cause. The law of pressure by fluids in motion—as affected by volume and velocity—must here come into play. As the blood is directed in greater quantity or at a more rapid rate through particular vessels, the active pressure will there be greater or less. Then, of course, the brain itself is not a fluid body. Its cell elements and fibres may be kept closer or more apart, according to the disposition of the fluids by which it is surrounded and saturated. As it can readily be understood that a certain compactness, or, it may be, freedom to move, may be necessary for proper functional action, the intensity or direction of the currents may, from their purely mechanical effect, stimulate, modify, or suspend activity through the whole organ, or in limited portions of its mass.

Recurring now to the case of the brain passing from the rest of sleep to the activity of wakefulness, we have to consider in what manner the intracranial pressure is modified. During sleep the brain circulation is quiet, and stress within the skull is weak; as activity sets in the molecular agitation and the increased impetus of the circulation cause the stress to be augmented. But something more than a change in the intensity of intracranial stress must take place. The balance of active pressure is also greatly altered. To show in what manner this occurs we may reverse the order in which the changes succeed one another, and see what happens as sleep comes on.

From exhaustion, or some other cause, the molecular movements become less energetic, and simultaneously the hold of the capillaries on the arterial blood is weakened. But there are other physical agencies at work within the skull, and the action of these cannot remain unaffected by such a change. For example, we have seen there is at all times a special stress within the veins. The combined cardiac and capillary forces urge more blood into them; the passive resistance of the atmospheric pressure tends to keep back that blood within the skull; and, lastly, the expansive action of the brain tends to

obliterate the vessels themselves by pressure on their sides. Of these forces, that caused by the atmospheric pressure varies least in amount. We have therefore to do with a simple problem in the composition of forces. If one or two be relaxed, the third must bear with greater effect. Thus, if the forces which cause brain-expansion act with less energy, the backward pressure in the veins must act with more decided effect. The flow of blood from them will be retarded so long as the equilibrium tends to be disturbed. When the new equilibrium is gained the vessels will be more distended than can possibly occur during a more active state of the brain.

The same change may be expressed in another way. If the brain tends to retire from the inner surface of the skull (and that it does so during sleep is the unanimous testimony of all who have observed its behaviour through an opening in the bone), it will exert a suction effort on the blood in the veins. It is impossible for suction to be exerted on the cerebro-spinal fluid in the spinal canal, for the contents of this cavity are also removed from the direct action of the atmospheric pressure.[1] A new balance of the circulation is therefore established; less blood circulates in the capillaries of the brain, and to an exactly corresponding extent more must be held by the veins. If a survey be taken of the various conditions involved, it will be seen that this change is a *physical necessity*.

If we are now allowed to assume that when the brain passes from rest to activity, or from activity to rest, a change occurs in the balance of its circulation, then, in accordance with the principle we have insisted on, the balance of active pressure within the skull must also be altered. This change of pressure will of course affect the disposition of the brain tissue, and must have an influence on its activity of function. During wakefulness, when the arterial and capillary circulation is most active, the pressure is outwards. It is expansive, and the reaction against the cranial walls causes the stress through the whole cavity to be increased. Nervous energy is liberated,

[1] I have elsewhere ('The Causation of Sleep') fully discussed the improbability of the cerebro-spinal fluid taking the place of the diminished cerebral circulation in healthy sleep.

and the result is some psychical or motor change. During sleep the venous circulation preponderates, and the pressure is from the surface inwards. The amount of blood within the skull may remain as before; indeed, I believe that in healthy sleep it must remain almost exactly the same. But a larger proportion of it is now external to the brain mass, and its movement there must react physically on the brain. The latter is more or less compressed. When the molecular movement began to flag, the capacity for active function was by that very fact also weakened. But this change of pressure still further interferes with functional capacity. When it amounts to a certain degree, function is suspended—the brain for the time fails to subserve the manifestation of the higher mental states.

We thus seem to find that, in the physical changes which accompany rest—in the more sluggish molecular movement with (as a necessary consequence) lessened intracranial stress, altered balance of the circulation and altered balance of pressure—we get a physiological explanation of sleep itself. We are furnished with a mechanism which secures a rest to the brain sufficiently lengthened to allow restorative changes to occur. No fact in brain biology has been better ascertained than that compression of the organ produces unconsciousness, and this first condition of sleep we find in the distended veins of the pia mater. Then, the whole agency being under the control of the molecular activity, the pressure may be graduated infinitesimally, so as to produce the lightest slumber or a state of heavy stupor. Further, if a stimulus be applied to the brain, the whole series of conditions can be changed *at once*. In this important respect the above theory of sleep contrasts with any other which places the cause in a change of nutrition alone, or in the action of some vaso-motor centre. We need not wait till superfluous cerebro-spinal fluid has been got rid of. The increased capillary and diminished venous circulation will be simultaneous.

The next step of our inquiry should now be to consider some questions relating to the balance of pressure through the brain itself. Assuming that the more immediate seat of active function is also the sphere of greatest vascular activity, we

should likely find that the activity of one part of the brain may affect the function of other parts in various other ways than by direct connection through commissural fibres. In one case, function may be suspended by a derivation of blood from its vessels, as when impressions on a sensory nerve are not felt on account of the mind being absorbed in a train of thought; in another case, an increase of energy may be occasioned from the steadier fulcrum-like support afforded, as when the intensity of muscular contraction is increased by the simultaneous action of other muscles; in a third case, the mechanical impulse of pressure may act as a direct stimulus, as when a sudden noise causes one to start, or, indeed, as may possibly occur in the causation of voluntary motion. Into this wide field, however, we cannot enter in the meantime.

Critical Digests and Notices of Books.

Manual and Atlas of Ophthalmoscopy. By W. R. Gowers, M.D., F.R.C.P. Churchill, 1879.

It would be difficult to light upon a new book more welcome than a Treatise on Ophthalmoscopy by Dr. Gowers. The difficulties of the eye-mirror are really so great that insistance is our only chance of keeping its value before the body of the profession.

Even among the younger men the number who have gained or who keep up any facility with the instrument is a small one; and of this number, again, many fail to detect ophthalmic disorders, on account of the awkwardness of examinations in private houses. The consultant often sees patients at his chambers, with all the conditions of successful investigation complete. The family attendant, on the other hand, sees them at home, and has to struggle with a chandelier, or to court a gleam from an irresponsive bracket—even a candle-end is hard to find in these days of gas, and every one does not know how good a torch is to be made by twisting together half-a-dozen of the wax tapers used by servants for lighting chandeliers.

Dr. Gowers' book has taken shape from beginnings of a thoroughly practical kind. He tells us his first idea was simply to collect drawings of the morbid eye in medical cases; as these drawings became more numerous and valuable he contemplated an Atlas, and finally the scheme grew into the present illustrated volume. With so much first-hand material, both of pen and pencil, we should have found the publication of a dry atlas rather disappointing. As it is, the clinical record obtains from the plates a great additional help and

vividness, and the reader has the advantage of facts *subjecta oculis fidelibus*, and thus permanently fixed upon his memory. Well-chosen and well-executed woodcuts also are inserted in the text, a large number of which are original, none of them trivial or familiar. The drawings of minute pathology are also among the chief attractions of Dr. Gowers' work.

More immediately attractive, however, are the drawings of the fundus of the eye—some in full colour, others in sepia, all of which are original, and all illustrative of cases recorded. There are twelve sheets of these drawings, each containing from two to six figures. The microscopic sections occupy no less than twenty-eight lithographs. All these drawings—more than eighty in number—are not only published for the first time, but are drawn by the accomplished author directly from his own subjects. The autotypes in sepia seem to be a very happy thought, fulfilling, as they do, all the proper purposes for which they are designed. They have the true economy of effort, expressing just what is wanted and no more. In discarding the name of Atlas, therefore, it will be seen that the author has not discarded the substance.

After the Introduction, the first part of the letterpress deals with the retinal vessels and optic nerve, so far as these have a medical significance. Many remarks in this chapter betray the practised and skilful observer; for instance, the acute observation (p. 11) that increased width of vein does not necessarily mean over-distension, but that wide veins may be underfilled and atonic. In this case the veins, according to the author, have an elliptical section, enclosing thus a smaller lumen than a circular outline. Dr. Gowers says that atheroma is never to be detected in the retinal artery, either during life or on autopsy, though it may in rare cases be the seat of aneurism. In discussing the changes of the optic nerve, the author writes some valuable paragraphs on the issues of inflammation in cases long under observation (p. 47 et seq.); he insists with all other observers upon the now well-known though strange fact that good ordinary vision can persist with full neuritis, even descending neuritis, and he supplies a great omission in my own book, namely a description of the changes in the field of vision, and of colour perception. The gradual

advent of colour-blindness was unknown when I wrote, and although the changes in the visual field were beginning to receive attention, yet work in this direction was then so recent and so incomplete and the bulk of my notes so imperfect in these respects that I could not handle the subject. But the importance of these inquiries is paramount and sometimes of crucial value in diagnosis.

Dr. Gowers offers a new terminology of optic neuritis, and I admit that its causation needed re-discussion. The sections (p. 63 et seq.) on this subject are very able, and treat of the bases of our views of optic neuritis and its relations; we do not find that the subject is worked out to a settlement, but we certainly find it advanced a stage, especially by means of post-mortem investigations.

The second part deals with the ophthalmoscopical changes in spinal diseases. As the reader passes quickly from section to section, he will find with regret that Dr. Gowers unfortunately has to agree with all observers in failing to find any direct reflection in the retina of degrees of anæmia and hyperæmia of the brain. In softening of the brain he finds optic changes to be more frequent than hitherto has been supposed. In tumours, he testifies of course to the frequency of optic neuritis, but fails still to find out the connection between the two events. In some cases the optic neuritis seems to move *pari passu* with the advance of the tumour, in others to take an episodic cause of its own. The size and nature of the tumour seem to have nothing to do with the causation of optic neuritis. Under meningitis, we find still some ophthalmic evidence that this disease, as I urged long ago, occurs in slighter degrees more often than we are aware, and that even when well marked it does not always destroy life. Dr. Garlick has produced some remarkable testimony to the same effect. Under spinal diseases Dr. Gowers says that ophthalmic changes are less common in locomotor ataxy than is supposed, and herein I think he is right. He thinks indeed the percentage will come out even less than fifteen per cent. A curious case is given by the author and Dr. Buzzard, in which optic atrophy and loss of "knee reflex," appeared long before the gait became affected. It seems clear at any rate that the

changes in the eye do not depend directly upon the degeneration in the posterior columns. The extreme rarity of optic atrophy in lateral sclerosis is still attested. I have never found this coexistence; a single case is published by Dr. Gowers; but in it, if the diagnosis be clear, the conditions were far from simple. In disseminate sclerosis I have found optic atrophy more frequently I think than Dr. Gowers indicates, but the disease is not very common in Yorkshire. Of optic changes in injuries of the spine the author speaks little, and well says that in litigated cases the morbid changes are more often in the mind of the observer than in the eye of the observed. Of this I may give an instance. An eminent ophthalmic surgeon, in a "railway case" tried last year at Westminster, found changes in the optic nerves and retinæ of the plaintiff so grave in kind that he positively prophesied complete blindness in eighteen months from that date, namely about June 1879. The evidence of other ailment was weak, and Lord Justice Coleridge said frankly that the verdict would depend on the value of this ophthalmic testimony almost alone. Although the two other observers called into the box had been unable to detect any morbid changes in the eyes, the jury naturally feared to defy the confident assertions on behalf of the plaintiff, and gave very heavy damages. The judge proposed that execution should be delayed in order to test the prophecy of blindness, but the plaintiff failed to see the force of the suggestion, and he is, I understand, at present enjoying his fortune with all the advantages which good vision can bestow. Surely such a conflict as this upon facts which ought to be positive enough is anything but creditable to ophthalmic science, and Dr. Gowers, as we have seen, washes his hands of such controversies.

To return to the volume before us. On p. 157 we should have been glad to see some reference to that remarkable malady, herpes frontalis. Of the changes in albuminuric retinitis, Dr. Gowers gives clear account, but adds little or nothing to our present imperfect understanding of this curious event.

Under the head of Diseases of the Blood, we find an interesting and indeed remarkable chapter on the ophthalmic

changes which may follow large hæmorrhages. There seems to be a wide consensus of evidence that the loss of vision in these cases is not functional only, but often depends on actual and visible inflammatory changes in the disks and retinæ—the loss of sight being often permanent, and sometimes complete. Hæmorrhage from the stomach seems to be the most efficient cause of such permanent impairment of vision. In most cases the ultimate change is one more or less of atrophy. I am bound to say that such terrible consequences, which can scarcely be overlooked, have not been evident in my own practice, but it is needless to add how serious a matter it is. Happily this terrible consequence rarely follows traumatic hæmorrhages or therapeutical blood-lettings. The tendency in pernicious anæmia to retinal hæmorrhages is a different kind of process, and of this malady I have had exceptionally large experience; in my opinion the retinal hæmorrhages occur in the minority of cases, and are when they occur a sign of rapidly advancing or advanced disease. The section on the retinal changes in leucocythemia adds little but the author's valuable testimony to our previous knowledge of the process.

Most physicians who work with the ophthalmoscope have noted optic neuritis standing alone—apparently "idiopathic"—in young women. Dr. Gowers thinks it may follow sudden suppression of the menses in the manner that acute myelitis may do. I may add in like manner that I have lately thought that amenorrhœa may in some cases be the cause rather than the usual mere concomitant of phthisis. In such cases the phthisis has dated from a sudden suppression of the menses in healthy women coming of non-phthisical families.

As I ventured to say years ago, Dr. Gowers and Dr. Garlick state that choroidal tubercle is very rarely visible to the eye-mirror; Dr. Garlick searched for it in the Children's Hospital for two years, and found it but once.

The chapter on Lead-poisoning is short, but clear and good; and a good case of optic neuritis due to this cause is given with a drawing of the fundus. Concerning tobacco amaurosis, Dr. Gowers has little to add to Mr. Hutchinson's opinions. It seems probable that amblyopia is caused by the use of certain kinds of tobacco.

A series of test types and a scheme of tests for colour blindness are found in an Appendix, together with some useful hints on ophthalmoscopes and the method of their use. Skeins of green and purple wool are methodically used in Germany, and are better than coloured cards as tests for Daltonism. The series of cases upon which the work is founded and which have supplied materials for the Atlas are put together at the end, and form an invaluable body of evidence and means of instruction. Dr. Gowers has thus well met a real want, he has brought the study of medical ophthalmoscopy up to the present date; he has used old materials judiciously, and original materials extensively and carefully; and he has given us his results in a handsome and well-illustrated volume, of which not only the author and publisher but even the profession in England may be proud.

Medical ophthalmoscopy was established by the Germans, but the work before us completes the claim of England to an equal share in its later development.

T. Clifford Allbutt.

The Study of Psychology. By G. H. Lewes. London, Trübner and Co., 1879.

In accordance with the announcement made at the time of the death of the late Mr. G. H. Lewes, that his loss would not prevent the publication of more of his writings, the first posthumous work has now appeared, under the above title, and forms the first problem of the third series of his well-known critical and constructive 'Problems of Life and Mind.' Though of much less bulk than its companion volumes, it contains much that is instructive, and many readers will esteem it highly among all of the author's works, for it is occupied with questions that are of the highest interest, and are most warmly disputed at the present day; and a critical examination of antagonistic opinions, together with an expression of the views of so high an authority as the author, must needs assign to the work a high and lasting value; and it is worthy of remark that the author's special opinions neither have undergone

material alteration, though more definite and further developed, nor are less enthusiastically supported, than when he first wrote upon these subjects.

He begins by stating that certain preliminaries, common to all sciences, are required by the study of Psychology, viz., definition of the object and scope, the motive, and the method of the search. But, unfortunately, unlike the other sciences, there is still the utmost discord prevalent with regard to the aim of, and consequently the method to be employed in, this one. The chief hostile views are thus described (p. 1): "On the one side stands the ancient metempirical conception of a so-called Rational Psychology, with its deductive method of ontological research. Its adherents, even when condescending to what they call Empirical Psychology, so little regard the data of experience, that they quietly ignore the complex conditions of the living organism, and treat mental facts simply as the manifestations of a psychical principle, at once unknowable and intimately known, a mysterious agent revealed to consciousness. On the other hand, there is an empirical school which professes to confine itself to the data of experience, and to pursue the inductive method, discountenancing ontology and coquetting with physiology. This school keeps up the traditions of a psychical principle, independent of the organism, and of introspection as the exclusive method of research. Of late years there have arisen writers who have tried to effect a compromise, invoking physiological data for one class of facts, and only invoking the psychical principle when physiological data fall short." It is the last party with which the author is most closely allied, and which has made most progress of late; for it can scarcely be doubted that the co-existence of extreme opinions showed the science to be in a transitional state, and that a proper medium would be most efficacious in placing it on a definite and stable basis; but although the author's views are identified with the main current of modern speculation, he protests against certain courses into which it appears liable to drift. The chief cause of the movement has been the steady appreciation of the existence of universal and unfailing laws pervading mental phenomena: introspection, however, showing that

numerous breaks in the chain of causation, on the side of consciousness, prevented their due recognition in that way, the continuity must therefore exist only between processes beyond the range of reflection. Now the aid that modern science has rendered to Psychology has been to show that, instead of being obliged to rely on an *immediate* view of a continuous series of conscious states, which would be impossible, as we can neither extend our range nor shift our point of introspection, we may attain the same end *mediately*, by analogical reasoning. But, for this purpose, it is necessary to adopt a new method of research—to translate the facts of consciousness into terms of another class. The value of this method is the chief point of dispute, and though as yet confessedly in a very immature condition, its use is warmly advocated, though with cautions against its abuse, by the author. The new method follows from the assumption, for long tacitly, though fitfully, made by all, that organic and mental processes are strictly correlated; so that a complete analysis of the one would give an equally complete acquaintance with the other: and then, while some terms of the one series may be beyond our reach, the corresponding members of the other series may be accessible. On these points Mr. Lewes says: "Modern science has revolutionised the question by showing physiology and Psychology to be two aspects, instead of two distinct sciences." Again (p. 76): "Mental state and organic state are only two aspects of one and the same thing, distinct from each other in so far as they are apprehended in different ways, and expressed in different terms." And again: "Objectively we know a sensation as a vital fact or movement, a component in some conscious resultant, which may be present or not; this sensation lies out of introspection, but may be brought within its range experimentally. Thus, much becomes explicable on wider observation than introspection."

The problem being, as before mentioned, threefold, the contents of the book fall naturally into as many parts—occupied with the endeavour to answer the questions respectively—What should we study in Psychology? Why do we study it? and, How are we to do so? Though the main questions can

be thus isolated and clearly stated, we are as yet unable to give a complete answer to all of them; and even such answers as are forthcoming are scarcely susceptible of statement in terms less abstract than the questions. With reference to the incompleteness of even these preliminaries, Mr. Lewes says (p. 4): "The constitution of the science has still to be effected;" meaning thereby the negative process of *circumscription* of a class of phenomena, and its positive fixation by *specification* of the object and method of search: yet "a first approximation" may be made now, by adopting the methods of inquiry already within our reach. In answer to the first question, the author gives as a definition, which he undertakes to justify hereafter: "Psychology is the analysis and classification of the *sentient functions and faculties* revealed to observation and induction, and completed by the reduction of them to their *conditions of existence*, biological and sociological;" "for," he observes, "it is necessary to observe the medium with the organism." Elsewhere Psychology is defined more briefly as "the science of the facts of sentience."

Though careful to state that an analysis of the terms of the definition is not demanded of the science defined, belonging of course to a higher sphere, he goes a little out of his way to explain the nature of mind, in order to elucidate the subject, and make his general argument more easily grasped; thus, he says: "Mind is a form or function of life;" "the relation of mind to life being so plain that no one doubts it, yet so obscure that no one can precisely describe it:" and thus "Psychology is a branch of biology."

In expressing such a view of the filiation of the two sciences, it is remarkable how closely it resembles Aristotle's theory of the soul, according to which mind and life are homogeneous, differing only in speciality; and the resemblance is carried still farther by the partially isolated position he assigns to the most highly specialised human faculties, in correspondence with the "noetic soul" of Aristotle. He even touches upon the metaphysical question of the nature of mind—whether or not it may be regarded as a substance—in order to refute the theory of a psychical principle, for which he says there is no more evidence than for a vital principle or motor principle.

His metaphysical argument may here, for completeness, be briefly summarised, though probably it is already familiar; and it appears to us to contain a confusion between "percipere" and "percipi;" the ultimate of knowledge is feeling, which has two aspects—subjective and objective—mind being an abstraction generalised from the sum of the former aspects, the object-world an abstraction generalised from the sum of the latter. Hence he arrives at the somewhat strange conclusion that the subject-matter of Psychology (with sociology) and of cosmology is identical, and has in each case the same two aspects, but while the one aspect is prominent in the former, the other aspect is most prominent in the latter: and biology occupies an intermediate position, neither aspect being throughout the more conspicuous. The theory appears to us to contain a confusion concerning the question of the opposition of subject and object—the author seeming to forget that the contrast persists as vividly in *psychology*, although its *ontological* nature may be disregarded. This seems to be the objection raised by Professor Green to Mr. Lewes' metaphysics in his critique ('Contemp. Rev.' 1878). In contrast to Aristotle's *metaphysical* theory of the soul, Mr. Lewes regards mind rather in its bestowing sentience, than, like Aristotle, a peculiar power, as of a mainspring, upon the organism; but yet the latter opinion seems at least predominant when mind is described as a form of life.

Having declared the generic identity of mind and life, he proceeds to point out the specific distinction between them by discussing the relation of physiology and Psychology; for though both refer to the functions of the organism, yet "Psychology is beyond the province of physiology;" "physiology deals with physical processes, the organic conditions of production; Psychology with the products—processes which are, have been, or may again be conscious."

Here we may notice a few terms much employed by Mr. Lewes, and invested by him with a peculiar meaning, though not all adhered to with strict consistence throughout, in order to express his special views. First is a distinction he proposes and adopts between "Function" and "Faculty," the former connoting a native, the latter an acquired activity.

Next is a similar distinction drawn between "Mechanism" and "Experience;" the former signifying fixed, the latter acquired and variable structure or constitution. A very similar distinction separates Physiology and Psychology; the former being concerned chiefly with functions as the activities of a mechanism; the latter with faculties as the activities of experience. With these definitions we do not feel altogether disposed to agree, the distinction being not sufficiently radical—not of kind, but merely of degree. Further, it seems a pity to divest the word "Faculty" of a useful meaning it already expresses. And also we think "Experience" would be very advantageously used in a wider sense than here proposed, and as it really seems to be used here and there in the work, applied to the total sentient aspect of the organic constitution. "Sentience" is applied, as in the preceding volume, to feeling in its widest sense, "Consciousness" being restricted to introspection or reflection. Just as, in 'The Physical Basis of Mind,' the author repeatedly insists on the whole organism being involved in its every action, as the conditions of its occurrence, so does he frequently maintain here that the whole sentient organism is requisite to every psychical state.

The object and scope having now been set forth, the motives of the study are considered. They are the same as prompt the formation of other sciences—speculative (theological and scientific) and practical. On account of the latter, mind and society have received especial attention because of their great influence on human interests, and their relatively easy modifiability. Among the former, no explicit mention is made of the special bearing of this science on metaphysics, as being the key wherewith to unlock those ultimate problems which confront us, though it is implicitly stated throughout Mr. Lewes' works. By far the largest portion of the book is taken up with the question, How the study is to be conducted? First, the position of the science in the cyclopædia is described, to prove that the same method must be employed in all sciences alike. This assimilation with the other sciences is of comparatively modern origin, mind having formerly been considered as a distinct principle apart from the body.

The same laws are equally applicable to both groups of sciences, because, as previously shown, they are really the same phenomena regarded under different aspects. The author confesses that he has been so often perplexed and vacillating (and we venture to think that he never attained complete maturity) in trying to assign to Psychology a definite place, that he criticises the opinions of Comte, Mill, and Spencer, as the best means of putting forth his own by contrast. Comte, he says, did great good by making Psychology a branch of biology, but committed a great error in despising introspection. Mill, on the contrary, overrated introspection. Spencer, with whom Mr. Lewes of course closely agrees, displeases him in only admitting in a qualified way that the science of mind is only a branch of that of life, and in regarding consciousness as absolutely unique; he also differs on some subordinate points. The next stage of the inquiry is "to specify the method, and register the fundamental inductions," beginning with a chapter on the "Social Factor," whose recognition is the final step in establishing the constitution of the science. This important factor is (p. 76) "not simply an addition, like that of a new sense, which is the source of new modes of feeling; it is a factor which permeates the whole composition of mind." "The organism creates and is in time modified by the social medium." Lewes claims originality in showing the vast range and mode of operation of the social factor, e.g., sentiment and science are inexplicable by the mechanism which physiology treats of; for they involve experience which is possible only to the collective life. Thus society is a factor of the individual experience in a double sense—in providing the matter for experience, as well as the instrument by which this is conveyed, viz., language, on which depend tradition, science, and art.

In acquiring data, both observation and introspection are indispensable; the former to give facts about ourselves, other individuals, society, and history; but these always require to be supplemented by introspection, whose data are *certain*, while those of observation are *exact;* and by interpreting the results of one as terms of the other, certainty and exactness may be combined. But introspection, with numerous other limita-

tions, fails to show us the *conditions* of psychological facts, although it does not deny them; this is illustrated by a chapter on the freedom of the will. Consciousness tells us that we make a selection of one out of many motives; and "this power of choice endows a motive with superior energy;" and "besides the particular motives, we are conscious of a personality, which determines them to be what they are." But from the biological point of view the conditions are revealed, and determinism is plain; self is the incorporation of our past experiences, and bears the same relation to the individual volitions as the organism does to its constituent organs.

In discussing the use of objective analysis, the author warns against falling into the traps of "hypothetical physiology," an error too often committed at the present time by drawing unwarranted physiological conclusions from anatomical facts; and employed ignorantly "to conceal gaps in our knowledge." Objective analysis seeks to complete and verify the data of subjective analysis. It consists in reducing the facts of zoology (including anthropology) and history to their conditions in physiology and sociology; till this is effected, "observation discloses only symptoms, not causes." Next comes a discussion of some importance on the value of observations made on animals, to learn the possibility of a comparative psychology; but the general conclusion is, that though undoubtedly it would be of immense advantage if we could obtain the necessary data, yet these are really quite beyond our reach, inasmuch as our interpretation of the observations of the actions of animals into their supposed sentient states is too much biassed by anthropomorphism; for their feelings, even though homologous with ours, may be widely different when referred to an absolute standard. Therefore we shall never rightly understand animal psychology until we have a tolerably complete human psychology into which to translate it.

As a natural sequence to this argument, there follows an interesting comparison of animal and human attributes, but the author seems rather to make gradational differences obscure homological resemblances. It is certain that the chief qualities of man are wanting in animals; even the senses are not the

same, but similar. Even if the mechanisms were identical, there is much difference in experience; one important result of our more complex experience is reflection or consciousness. Animals have scarcely any sympathetic altruistic impulses except the sexual and parental; and are insusceptible of virtue or vice, wisdom or folly, the pleasures and pains of ideal life; which are all due, through language, to the social factor. By following out the operation of this factor through language, we can at any rate ascertain some of what phenomena are *not* to be found in animals. Their intelligence and passions become transformed into the intellect and sentiment of man. The moral sense is also a social product; though controlled by fear, animals cannot distinguish right and wrong; love of approbation is a great advance on the former sanction, though far inferior to the latter; but in even some human minds, "what is approved of" is the only aim of conduct. Still "the sanction which once was the outside whip has become the inward sympathetic pang." The author seems, however, to imply that egoism is a powerful factor even in the most lofty actions, when he says, "Much right action springs from healthy impulse." Opinion of what is right and wrong has been much influenced by the misguidance of superstition. Conscious judgment and immediate impulse are blended in all proportion, according to the relative influence of heredity and training. "The abstractions right and wrong become, in course of time, centres around which other emotions group themselves."

History affords an immense store of facts, whence we may infer the present conditions of society and the individual mind; it may be looked upon as an experiment instituted by society, just as disease is a natural experiment in physiology. It must always be resorted to, to teach how experience has grown; also, it thereby teaches the laws of the sentient faculties, especially moral and intellectual. The true logic of science is only shown in the history of science. The principles of art also are only thus to be acquired. The "general mind," much more even than the individual mind, is a historical growth. History also shows the growth of mind, a knowledge of which is as essential as is embryogeny to phy-

siology. Introspection does not suffice, but still the author holds that there is no warrant for Prof. Green's assertion that "the observation by the mind of the mind's genesis is the crowning absurdity of speculation." To us it appears legitimate to go farther than Mr. Lewes, and hold that introspection, aided by memory, can show us the greater part of the genesis of the individual mind. The "general mind" receives a special chapter: it is said to be a factor always implied in psychological discussions, though seldom clearly conceived, viz., the experience of the race in its influence on that of the individual. Every thought belongs to an impersonal reason—Humanity. A solitary man would think, &c., but would not form conceptions. Still the general mind is but an abstraction; not a "res completa." The units of society have a common impulse and a common end, common desires and opinions. The individual avails himself of the experience of others because his is so feeble. Civilisation is the accumulation of experiences; and the collective experience is the chief human attribute, it acts on the individual mind through the social institutions of scientific theories, works of art, and especially language. This is virtually the same as Hegel's description of the development of mind. But there is much prejudice and incoherence mixed with sound knowledge; and obscure beliefs are largely mixed with logically assignable premisses in drawing conclusions. Hence we see how great must be the chance of the superabundance of tares occasionally choking the wheat, and can understand the need of Bacon's warning against the four idols, and consider Descartes justified in starting with a universal doubt. A clear conclusion is to be had only in the exact sciences; quite the reverse in the moral sciences, and ordinary reasoning. Still the author remarks that "Hartmann's display of the operation of 'the Unconscious'" is an exaggeration. Conclusions once obtained become "necessities of thought" for the individual, e.g., the rules of arithmetic are now, and the law of evolution will be so in course of time. Still disciples of Kant are not to interpret these conditions of experience as the mental forms which form the essence of his system; but Mr. Lewes' criticism of Kant here appears scarcely as thorough as we could wish. The final chapter is to insist upon the necessity

of analysis and synthesis as implying each other. Just as in former pages the author blames crude materialism, so here he exposes the shallowness of sensationalism; for thought and the totality of experience is the presupposition of every particular sensation; and in dealing this blow to sensationalism, we think the author is doing good service.

We have now given, by free condensed quotations, a rough outline of this suggestive volume; still we cannot pretend to have presented its most delicate features, or even to have accurately shown the author's peculiar views; however, we feel sure that all who are interested in the subject will supply these from the original, and we should be much surprised if they do not look forward with pleasure to the appearance of the next promised volume.

F. L. Benham, M.B.

Etudes Cliniques sur les Lésions Corticales. Par le Dr. Henry C. de Boyer. Paris, 1879. 8vo. pp. 230.

In this very exhaustive and copiously illustrated monograph M. Boyer gives a *résumé* of the methods and results of recent researches on the anatomical and physiological topography of the brain, and reviews the whole of the clinical evidence bearing on the localisation of cerebral functions. He quotes and gives references to 360 cases of lesions of the cerebral cortex. The following are among the chief conclusions which he founds on his analysis of these facts.

That the occurrence of motor affections with cortical lesions depends on the seat of the lesion. Lesions of the following regions are unaccompanied by motor symptoms: 1. On the *inferior* aspect, the occipito-temporal and orbital regions; 2. On the *superior* aspect, the anterior two-thirds of the territory of the anterior cerebral artery, and the whole extent of the territory supplied by the posterior cerebral artery; 3. On the *internal* aspect, the territory of the anterior internal frontal, and that of the middle internal frontal in its anterior half, the cuneus, the posterior half of the præcuneus, and the whole of the temporal convolutions; 4. On the *external* aspect,

the latent region is co-extensive with the domain of the anterior and posterior cerebral arteries. Lesions of the parieto-occipital region may also occur without hemiplegia. Occasionally in connection with lesions of the *pli courbe* oculo-motor-paralysis without paralysis of the limbs occurs.

The lesions accompanied with motor paralysis occupy the region of the fissure of Rolando and origin of the fissure of Sylvius. Aphasia is found associated with lesions (*a*) in the third left frontal; (*b*) the island of Reil of the left side; and (*c*) the left third pediculo-frontal fasciculi. The minimum extent of the lesion causing aphasia is the posterior third of the third left frontal round the ascending branch of the fissure of Sylvius, but especially in the operculum and base of the convolution.

Some conclusions as regards localisation may be founded on cases of partial epilepsy—which never occur with lesions on the inferior aspect of the hemisphere—but with less certainty than from cases of monoplegia or partial paralysis. Of monoplegia we have cases of aphasia, facial monoplegia, brachial monoplegia; more rarely, crural monoplegia. We may also have ptosis, rotation of the head to one side, with or without conjugate deviation of the eyes. Of associated monoplegia we have cases of face and speech, face and arm, arm and leg, but never, with circumscribed lesion, of face and leg, or speech and leg. The arm centre therefore separates that of the face and leg.

These centres are arranged from below upwards from the insula to the paracentral lobule along the fissure of Rolando, and correspond to the descending order of the muscular groups which they set in action. The speech centre is the posterior third of the left frontal; the face centre the base of the ascending frontal and parietal; the arm centre, the middle third of the ascending frontal and parietal; the leg centre, the upper third of the ascending parietal. The cerebral origin of the third pair of cranial nerves perhaps occupies different points of the pli courbe and inferior parietal lobule. The centre of rotation of the head is probably situated at the base of the second frontal convolution. These two latter centres, however, are not yet satisfactorily localised.

It is difficult to determine with exactitude the extent of the arm centre, as a part of its territory is common with that of the leg; yet as isolated movements of the arm and leg are the rule, and as brachial monoplegia does occur, we may suppose, either (1) the existence of a centre common to arm and leg, and distinct centres of certain movements of the arm and leg; or (2) the superposition in different layers of the cortical substance of two centres, the one for the leg, extending towards the parietal lobule, the other, for the arm, descending towards the middle third of the ascending frontal; or, (3) a union in some cortical regions of cells for the arm and leg, or of fasciculi, with a maximum for the arm below and the leg above.

There exist two zones which may be termed *neutral*, without prejudging their functions; the one occupying the superior parietal lobule, the other the neighbourhood of the paracentral lobule, that is, the anterior half of the præcuneus and a part of the gyrus fornicatus.

The observations relative to circumscribed lesions of this zone do not serve to determine whether it is motor or not. It is probable, however, that it belongs to the latent zone.

One of the constant anatomico-pathological characters of cortical lesions is the occurrence of secondary degeneration in the lateral columns of the spinal cord. The atrophy of a centre in consequence of arrest of the functions of the limb which it governs cannot be regarded as sufficiently well established. The sensory centres of the cortex appear to be situated in the zone which is latent as regards motility, but we have not yet sufficient evidence to enable us to fix their precise situation. The vaso-motor centres are less certainly determined than the last.

D. Ferrier.

Lectures and Essays. By the late WILLIAM KINGDON CLIFFORD, F.R.S., late Professor of Applied Mathematics and Mechanics in University College, London, and sometime Fellow of Trinity College, Cambridge. Edited by LESLIE STEPHEN and FREDERICK POLLOCK. With an Introduction by F. POLLOCK. 2 vols. Macmillan & Co.

"THOSE whom the Gods love, die young." It might have been said of those whom the Gods envy, if it were meant as a lament for the cutting short of precious and promising life, and the waste of gifts and faculties which have been called divine. It may be that these gifts appear more precious in the young than in the aged, and that after the wear and tear of a long life the possession of them might be questioned in the very men who in earlier years have appeared the most gifted, and the most blessed. But perhaps the assertion is only one film of the disguises in which sorrow is accustomed to hide itself deep in proportion to the loss it has sustained, and which, if life be worth having, as we believe, has a right to be the greater, in proportion to the amount of precious life which has been cut off.

The subject of this Biography and the author of these Essays might well be said to be one whom the Gods loved, for he was abundantly blessed with their most precious gifts. To marvellous power, facility, and range of intellect, in him was added the exquisite charm of a sweet and genial temper, a sympathising disposition, loving and compelling love, "a merry heart which goes all the way," and a sincerity which made itself felt and could not be doubted. Probably it was the addition of this truthfulness and trustworthiness to the intellectual light and emotional sweetness of Clifford's character which so strongly drew comparative strangers towards him, as his biographer mentions. And when to these qualities are added a modesty and simplicity which made him childlike, and a gaiety of humour which made him brilliant, a character is completed which is here lovingly and faithfully portrayed in the affecting biographical sketch of one of his intimate friends.

Intellectually Clifford did not strike one as a giant like his old master Whewell, and the account of his acquirements given by his friend is in these days of universality not overwhelming. He was rather a *preux chevalier* of intellect, reminding one of the qualities of Sir Launcelot when he went disguised to win the diamond necklace at the last tournament; —it was the grace and versatility of the man which distinguished him from the other combatants. "Nihil tetigit quod non ornavit," and he did touch and adorn many things. Power alone is not genius; but power, combined with versatility and a quality for which we can find no better term than notional instability, comes very near to that rare and precious product. There is nothing farther from what we mean by this term than fickleness, or uncertainty; we mean, rather, a ready faculty of changing the direction and combination of ideas. In some minds, and powerful ones too, certain groups of ideas always hang together; they never split up and recombine. They are pretty certainly prompted by ideas and followed by other ideas which, if you knew your man you might predicate. But in a man of genius, ideas readily split up and recombine with others, according to the rules of inorganic rather than of organic chemical change, thus producing a greater and more beautiful variety of thought, illustration, and eloquence. Genius has power of quick change in the direction of thought, like that which Clifford showed physically in his gymnastic corkscrew, consisting in "running at a fixed upright pole which you seize with both hands and spin round and round, descending in a corkscrew fashion," and this ideational instability belonged to him in a pre-eminent degree, though the mental change was mostly from the tortuous to the direct; it was manifest in his discourse, and is one of the most marked characteristics of his writings.

We think the biographer has not done full justice to the beauty of his literary style in saying: "I do not think he cared much for the use of language as a fine art, though he had a great appreciation of arrangement and composition. His own style, always admirably clear and often eloquent, was never elaborate." But whether Clifford cared or not, his use of words *was* a fine art, and it would be difficult in English litera-

ture to match his style for the beauty which results from a combination of simplicity, lucidity, and power, more fairly than by likening it to that of Jonathan Swift.

This sketch, however, of a simple life is as interesting and pathetic as keen appreciation and fine characterisation can make it, reminding one of those biographical elegies to his friends which have recently been published by Oliver Wendel Holmes.

The biography is followed by extracts from a few letters, only enough to whet one's appetite for more. The Lectures and Essays which follow represent Clifford rather as a teacher than a debater, or even as a thinker, though the most popular among them are full of originality either of his own thought or of his method of putting the thought of others. Many of them will be full of interest to the readers of 'BRAIN,' as must be obvious from their titles: 'Conditions of Mental Development;' 'Theories of the Physical Forces;' 'Body and Mind; 'Right and Wrong;' 'The Ethics of Belief;' 'Virchow on the Teaching of Science.' Perhaps the last of these Essays, which we are told was written at one night's sitting, is as remarkable as any of them, as an example of the author's power of placing difficult problems before his readers so that no one can fail to understand, not only the general argument but the shades of probability and degrees of belief, which could rightly be attached to many different propositions. It is of course founded on the well-known argument between Haeckel and Virchow, not only as to what is really proved on the evolution theory, but also how much of it it would be right to teach children; and those who have mistakingly thought Clifford extreme in all his opinions will be surprised to find that he endorses the moderate conclusions of Virchow, and the exposition of the degree of credibility of the two propositions which he agrees to be unsettled, are a good specimen of his power, fairness, and lucidity in the statement of argument. These propositions are: 1st. The Descent of Man from some non-human Ancestor. 2nd. The Doctrine of Spontaneous Generation. But for the purpose of an example of his matter and method, we prefer to give a quotation from his earlier paper on 'Body and Mind.' After having described the physical changes involved in the reception of sensation and its conver-

sion into motion, he thus argues as to whether or not there be any change over, above, and beyond these physical changes.

"Now the question is, Is there any creation of energy anywhere? Is there any part of the physical progress which cannot be included within ordinary physical laws? It has been supposed, I say, by some people, as it seems to me merely by a confusion of ideas, that there is, at some part or other of this process, a creation of energy; but there is no reason whatever why we should suppose this. The difficulty in proving a negative in these cases is similar to that in proving a negative about anything which exists on the other side of the moon. It is quite true that I am not absolutely certain that the law of the conservation of energy is exactly true; but there is no more reason why I should suppose a particular exception to occur in the brain than anywhere else. I might just as well assert that whenever anything passes over the line, when it goes from the north side of the equator to the south, there is a certain creation of energy, as that there is a creation of energy in the brain. . . ."

"It may be conceived that at the same time with every exercise of volition there is a disturbance of the physical laws, but this disturbance being perceptible to me, would be a physical fact accompanying the volition, and could not be the volition itself, which is not perceptible to me. Whether there is such a disturbance of the physical laws or no is a question of fact to which we have the best of reasons for giving a negative answer, but the assertion that another man's volition, a feeling in his consciousness which I cannot perceive, is part of the train of physical facts which I may perceive—this is neither true nor untrue, but nonsense. . . ."

"The mind then is to be regarded as a stream of feelings which run parallel to, and simultaneous with, a certain part of the action of the body, that is to say, that particular part of the action of the brain in which the cerebrum and the sensory tract are excited. . . ."

"But we have to consider not only ourselves but also those animals which are next below us in the scale of organisation, and we cannot help ascribing to them a consciousness which is analogous to our own. We find when we attempt to enter into that and to judge by their actions what sort of consciousness they possess, that it differs from our own in precisely the same way that their brains differ from our brains. . . ."

"The only thing that we can come to, if we accept the doctrine of evolution at all, is that even in the very lowest organisms, even

in the Amœba which swims about in our blood, there is something or other, inconceivably simple to us, which is of the same nature with our own consciousness, although not of the same complexity; that is to say, we are obliged to assume, in order to save continuity in our belief, that along with every motion of matter, whether organic or inorganic, there is some fact which corresponds to the mental fact in ourselves. The mental fact in ourselves is an exceedingly complex thing; so also our brain is an exceedingly complex thing. We may assume that the quasi-mental fact which corresponds and which goes along with the motion of every particle of matter is of such inconceivable simplicity, as compared with our own mental fact, with our consciousness, as the motion of a molecule of matter is of inconceivable simplicity when compared with the motion in our brain.

"This doctrine is not merely a speculation, but is a result to which all the greatest minds that have studied this question in the right way have gradually been approximating for a long time."

We should have thought that the consciousness of inorganic matter was one of those things which the author would have put behind the moon—as one which may or may not be, but which it is, can never be known. Moreover, the complexity of the brain may be a measure of its consciousness, but is no reason for it. The kidney is also complex and so is Babbage's machine; but the complexity of the brain is important, because the organ has been developed for consciousness, and even in comparing acknowledged examples of consciousness in animals, there must be a vast interval between that of an animal possessing an organ developed for it and of an animal in which there is no centre of sensibility. Elsewhere, Clifford says in a letter,

"I am a dogmatic nihilist, and shall say the brain is conscious, if I like. Only I do not say it in the same sense as that in which I say that *I* am conscious. It seems to me that not even Vogt, however you fix it, can talk about matter for scientific purposes except as a phenomenon; that in saying the brain is conscious—or, better, that *you* are conscious, I only affirm a correlation of two phenomena, and am as ideal as I can be."

This combination of metaphysical idealism with scientific belief and method, not peculiar to Clifford, is, however, a somewhat new philosophical position, far more difficult to assail than that of pure realistic science. Clifford had worked

out his metaphysics a good deal for himself, he had read little on the subject, his favourite authors, however, being Spinoza and Berkeley.[1] Had he lived, he would, we think, have been likely to have left a strong and deep mark upon the metaphysical speculations of his time, from his habit of ever attempting to get at the central truths of speculative opinion from new points of view. The volumes before us are full of instruction and interest.

JOHN CHARLES BUCKNILL.

[1] On this question of consciousness we remember a paper of Clifford's which we do not find in the present collection, and in which he drew an important distinction between the ordinary objects of consciousness, and our consciousness of other consciousness, which indeed is proved to us objectively, but which we do not recognise as in itself an object.

Clinical Cases.

CASE OF PURULENT CEREBRAL AND SPINAL MENINGITIS—NO SYMPTOMS—SUDDEN DEATH BY COMA.

UNDER THE CARE OF JOSEPH W. HUNT, M.D. LOND.,

Wolverhampton and Staffordshire General Hospital.

MARTHA V., æt. 60, married, came to the out-patient room Feb. 27th, complaining of dyspnœa and pain in the back.

As she came from a great distance, she was at her own request admitted as an in-patient, though scarcely considered fit for admission.

On examination in the wards she was found to be rather badly nourished. Expression careworn. Capillaries in face well marked. No general or local œdema. No cutaneous eruption. Temperature, taken in armpit, normal (at night). She complained of much pain in the lumbar region, which was greatly increased by walking, coughing, or by raising herself up after stooping. It had been present, with only short intervals, for nearly fourteen years, and never extended into any of the limbs. There was no spinal tenderness beyond a little undefined uneasiness on firm pressure being made over the base of the sacrum. No headache. Sight and hearing good. No ophthalmoscopic examination was made. Intellect very good. No abnormalities with regard to either motion or sensation. Slept well. Considerable dyspnœa on exertion, but only a little cough and very scanty expectoration. Physical signs of emphysema well marked. Cardiac impulse and sounds weak, and some cardiac dilatation. Tongue clean. No vomiting. A tendency to constipation and some dyspepsia. Urine 1016: acid, rather turbid, with a deposit of phosphates on heating, abundant in quantity; no albumen.

The diagnosis of muscular rheumatism and emphysema was made, and patient was ordered potass. bicarb. gr. xv., inf.

calumbæ ʒj ter die, and the bowels were kept regularly open with liquorice powder.

Under this treatment the patient improved rapidly. The muscular pain almost entirely left her. She was able to get about the ward well, and expressed herself very grateful for what had been done. No fresh symptoms declared themselves. On March 7th, eight days after admission, she breakfasted at 6 A.M. as usual, and told the nurse how much better she was. At 8 P.M. she was observed by the nurse to be to all appearance asleep; but on a closer examination the nurse was alarmed, and Dr. Russell, the House Physician, was summoned. He saw her at once, and made the following notes: Patient lying on her back, and breathing heavily and noisily; eyes closed, but on being sharply addressed they were opened, and patient would try to speak, but never uttered more than "Ah!" Pupils reacted to light: about normal in size, the left being a little more contracted than the right. No strabismus, and no cranial paralysis. She swallowed her drink well. The tongue was not protruded, though it was occasionally seen to move about in the mouth. No paralysis of limbs, which were frequently moved in a restless manner, and almost invariably whenever they were pricked. There was no exaltation of sensibility, but rather the reverse, though patient could feel a prick on any part of the body. The legs were bent up in bed, especially the left; in this limb the leg being strongly flexed on the thigh, and the thigh on the abdomen, so much so that before death the knee almost touched the abdominal walls, but at times she fully extended the limbs. Face rather cyanotic. Urine passed into bed. Pulse 120, irregular in force and rhythm, and intermitting. Temperature carefully taken by Dr. Russell. Right axilla 103°. Left axilla (same thermometer) 102·4°.

1 P.M.—No marked change. Temp. at right axilla 101·7°; left, 100·6°. Over the frontal regions the temperature was about the same on the two sides (101·5°). She did not recognise her friends who visited her at about this time. There was slight retching, but no vomiting. Once or twice, for about five minutes, nurse noticed some twitching of the lower lip, most marked on the left side.

5 P.M.—Temp. right axilla, 101·8°, left, 101°. Eyes kept open, instead of closed.

8 P.M.—Pulse 132, much weaker, and very irregular; no evidence of paralysis anywhere. When the limbs are raised they fall gently, and not as a heavy weight.

She died comatose at 11 A.M., 27 hours after onset of coma. Post-mortem made and reported by Dr. Russell 24 hours after death. Rigor mortis and hypostasis well marked. Calvarium

removed in usual way. Exterior of dura mater normal, but on cutting through it a considerable amount of pus flowed out; and on removing the dura mater the surface of the brain was seen to be covered with pus in its greater part. It was most plentiful over the posterior portion of the frontal convolutions, the ascending frontal and the ascending parietal, and the 1st, 2nd, and 3rd parietal convolutions; and at those situations too it was removed with greater difficulty when a stream of water was poured on the surface. There was no marked difference in the amount of pus between the two sides. The anterior half of the frontal lobes and the occipital lobes were pretty clear of pus. There was pus too at the base of the brain, but none over the cerebellum nor about the medulla. The membranes were much injected. Vessels normal, considering the age of the patient, and there was no thrombus or embolon in the larger vessels. Sinuses normal. There was no disease of the bone found, though it was carefully looked for, and each internal ear was healthy. No appearance of a fracture or fissuring in the skull. On section of the brain, the puncta cruenta were seen to be more than ordinarily numerous and well marked. The white substance was of a brownish-pink colour throughout, but both it and the cortical substance appeared to be of about normal consistence. No lesion of any kind was seen in any portion of the brain. On reflecting the dura mater of the cord it was seen to be bathed in pus throughout, with the exception of the upper three inches, and equally so in front and behind. The dura mater was normal in appearance, but the other membranes were markedly injected. The substance of the cord was in every way normal to the naked eye. The vertebræ were healthy. Heart weighed 10 ounces, right side dilated, substance soft. Lungs emphysematous. Spleen, 6 ounces, very pulpy. Kidneys, 4½ and 5 ounces. The capsules of both were adherent in places, and markedly so in one kidney, so that the renal substance was much lacerated in removing the capsule. Both contained cysts in their cortex. There was some retroperitoneal hæmorrhage in the neighbourhood of the left kidney, but no lesion in the kidney or ribs to account for it. No abscesses or emboli found in any portion of the body.

Remarks.—The history of this case presents several points of interest. Non-traumatic meningitis is by no means a disease of frequent occurrence in advanced life, but the opposite. True, several instances are to be found scattered throughout various publications, especially those of France and Germany, and Schönlein (as quoted by Day) even goes so far as to write that meningitis is especially a disease of old age; but, on the

other hand, those investigators who have laboured at such institutions as the Bicêtre and Salpétrière—Durand Fardel, for instance—mention the rarity of this disease, and more especially of the purulent form. The cause of the affection in this particular case is involved in obscurity. No history of injury was obtained, and the surrounding bones and the internal ear were healthy. As far as was known, she was a temperate woman, and the post-mortem condition confirmed this—and even if it were otherwise, it is doubtful whether alcoholism is anything more than a predisposing cause. It is possible that the meningitis may have been associated with the cirrhotic changes found after death, though during life there were no indications of renal disease. Dr. Maclachlan writes in his work on the 'Diseases of Advanced Life:' "Almost every case occurring in the old may be traced to one of three sources, gout, rheumatism, or albuminuria." The history of the case is strongly against the idea of its being epidemic cerebro-spinal meningitis; moreover, this latter disease is very rare in those over 50. Except in very severe epidemics, it is never so apoplectic in its course, and, post mortem, the posterior portion of the dura mater of the cord is always found to bear the brunt of the affection.

That this was a chronic affection with latent symptoms is controverted by the normal thickness of the membranes and the naked-eye appearance of the inflammatory products, though of course it is most probable that the disease commenced some short time before she became comatose. The fact that a patient apparently in good health should suddenly become comatose and die in 27 hours, and nothing but purulent meningitis be found post mortem, must considerably complicate the diagnosis of the causes of apoplectic seizures. Dr. Maclachlan, in his work already referred to, mentions cases of meningitis of an "apoplectic character," and adds that there is generally a history of intemperance. A case is recorded in the 'Medical Times and Gazette' (Nov. 2, 1867), under the care of Dr. Hughlings-Jackson. The patient was picked up in the streets, and, with help, walked to the receiving-room of the hospital, where he became comatose with stertorous breathing, and died 26 hours afterwards. The lesion found after death was purulent meningitis. In his case he had complained of considerable headache a few days previously.

CLINICAL CASES OF HERNIA CEREBRI.

BY JOHN DUNCAN, M.A., M.D., F.R.C.S., ETC.

Surgeon to the Royal Infirmary, Edinburgh.

THE following cases at the time of their occurrence appeared to be merely ordinary examples of the curious variety of effect produced by similar injuries of the brain. Viewed now in the light of recent researches, and when so much that is important and valuable is being made out in reference to localisation of function in the brain, they assume a somewhat different aspect, and at least seem to me worthy of record.

On the 22nd of March, 1872, Stephen Maclachlan, a sailor, twenty-four years of age, was entering a boat to be rowed to his ship, then lying off a Spanish port, when he was struck on the head by a stone thrown at him from above. He was carried completely insensible to a neighbouring hospital, and remained so for several hours. Of his stay there we know nothing farther than that he was copiously and repeatedly leeched and bled, and that a companion, who visited him during the third week, observed a considerable swelling on his head at the seat of injury.

On leaving, after four weeks, he was taken home to Grangemouth by his friends, and thence transferred to the Royal Infirmary on the 11th of May.

On admission the patient was found to be a well-built powerful-looking man, but anæmic.

Over the left parietal bone, opposite the centre of the sagittal suture, was a large hernia cerebri, whose inner margin reached the middle line. Its antero-posterior diameter was 3 inches, its transverse 2 inches, and it was 1½ inch in depth. Its surface was irregularly nodulated, having a yellow sloughy aspect, but with here and there a few pale granulations. It overhung the surrounding skin. The hernia itself was quite insensible to touch, but the scalp under and about it was somewhat swollen and tender. The tumour pulsated strongly.

The following notes of his condition were made:—

The patient has lost the power of speech. He makes no attempt to speak, and if asked to repeat a word, he can only very imperfectly imitate the sound of the most prominent syllable. He cannot write the shortest word, and makes curiously unpronounceable combinations of things that look like letters.

His intelligence, however, appears good. He can make signs expressive of simple wants, and by nodding or shaking his head he answers with correctness questions that require considerable reasoning power. If spoken to quickly, he requires a little time to understand, and sometimes the question has to be repeated.

He has completely lost the power of moving his right arm and leg. The right side of the face is paralysed. There is not much drawing to the left, but a distinct absence of expression when he laughs, and he smokes with the pipe in the left side of the mouth. The right eyelid droops considerably, and he cannot shut it completely unless he also closes the left. The tongue is protruded nearly straight. The bowels and bladder act perfectly. He has twitching of the right arm and leg, principally at night.

Sensation is normal on the left side. On the right side a light touch is not felt at all. There is a degree of pressure which gives him sensation, but without enabling him to say whether one or two points touch him. On very firm pressure with the compasses he distinguishes points almost although not quite as well on the right side as on the left. Pressure, rubbing, or other rough movement of any portion of the right side gives considerable pain. This is very marked in the arm and thorax, less so in the leg. He feels acutely if the sole of the right foot be tickled, but the reflex movement is only a slight twitching of the toes.

The right pupil is dilated, reacts slowly to light, and its vision is slightly impaired. (The ophthalmic report was unfortunately not preserved.)

He cannot hear the watch with the right ear unless it be applied to the auricle.

On the left side sight and hearing are normal.

No distinction can be made out between the two sides as to smell and taste.

All other organs seem to be healthy and working well. The appetite is good, the urine normal. Pulse 84, strong and regular; temperature 99·8.

Absolute rest was enjoined, and the hernia was dressed with carbolised oil.

The patient progressed favourably up to the 29th of May.

A certain amount of power returned to the limbs, especially to the leg, although a progressive diminution in the bulk of the paralysed members took place, in spite of the regular use of the induced current. The hernia looked more healthy, had slightly diminished in size, and a narrow margin of growing cicatrice was visible at the circumference. The pulse varied from 80 to 90, and the temperature from 99° to 100°·5.

On the 29th, however, he did not sleep well, and next morning the temperature had risen to 102° in the right axilla, 101°·5 in the left. On gently pressing the tumour a drop or two of pus could be made to exude from a very minute opening on the right side close to the base. Into this a probe could be introduced nearly one inch.

Next day there was a rapid rise of temperature to 108°, with much headache. The pulse fell to 64. The opening was enlarged, and a small quantity of pus evacuated.

No improvement followed, and next day, June 3rd, as he was becoming comatose, the hernia was sliced off, and an abscess cavity, the size of a walnut, was disclosed.

He went, however, from bad to worse. On the 4th he was completely comatose. The right pupil became enormously dilated, and there was most profuse perspiration of the whole head and face.

On the 5th a copious flow of what seemed diffluent brain-substance took place, and he died on the morning of the 6th of June.

During the last few days striking variations occurred in the temperature. At one time it would be 107° or 108°, and a few hours afterwards normal. In the right axilla it was generally a degree higher than in the left. The pulse remained under 70 till the evening before his death, when it rose suddenly to 150.

A post-mortem examination was made next day. On removing what remained of the hernia, an oval opening in the bone was disclosed, an inch and a quarter long by three-quarters of an inch broad. Its inner margin was one quarter of an inch from the suture, and on both sides the bone was considerably depressed. The anterior margin of the aperture covered the upper part of the ascending frontal convolution, the rest passed backwards over the ascending parietal convolution and the superior parietal lobe. The interior of the parietal lobe was occupied by an abscess cavity containing diffluent brain-tissue and pus. The upper part of the ascending frontal convolution was involved in the abscess, which otherwise corresponded with great accuracy to the parietal lobe. The rest of the brain appeared healthy.

On the 6th of June, 1869, David Fergusson, æt. 13, was kicked on the forehead by a pony, while playing with some companions in the stable. I saw him, along with the late Dr. Andrew Inglis, shortly after the accident. I found that the left temple was completely smashed. There was a circular orifice about the size of a penny in the bone, its upper margin just touching the hairy scalp. A small quantity of brain-substance lay among clotted blood on his cheek. In the wound lay a mass of blood and debris, and a piece of bone driven in edgeways for more than an inch into the brain. The pulse was 90, the temperature normal. He was able perfectly to describe the mode in which the accident occurred, and I learned that he had not lost consciousness for a moment. There was in short absolutely no apparent disturbance of function in any portion of the body. I removed the loose portions of bone, elevated a piece which was slightly depressed, and dressed the wound with a single layer of lint moistened with water.

It would be tedious to transcribe from my notes the uneventful history of the case. Let me merely say once for all that throughout there was no appreciable alteration in any function, bodily or mental. The comparative power and sensibility of the two sides of the body were carefully and repeatedly tested, and found normal. He was in all respects a quick intelligent boy, of a bright and pleasant disposition, and his father and companions frequently told me that they were unable to detect the slightest change in his mental capacity or disposition.

On the eleventh day after the accident a hernia cerebri began to develop. In ten days it attained the size of a small orange. From that time it remained stationary for four months, being left entirely to nature, except in so far as a most rigid cleanliness was observed. At the end of that time it began to dwindle, the cicatrice drew in from the margins, and six months after the injury a level pulsating scar was all that remained.

Shortly afterwards I lost sight of my patient.

After three years one of the resident physicians in the medical department of the Infirmary informed me that Fergusson was then dying of phthisis, a disease which had killed his mother. I saw him, and was present at the autopsy, and carefully examined the injured portion of the head.

An almost circular opening, one inch in diameter, with thin and smooth edges, occupied the left side of the frontal bone. From this, as a base, an irregular cone of cicatricial tissue extended into the brain for three-quarters of an inch. This cone occupied the centre of the second, and slightly the contiguous part of the first frontal convolution.

These cases present several points of interest, both in their clinical and pathological aspects.

The amount of brain-tissue directly injured was at least as great in the kick from the horse as in the blow from the stone, yet in the effect produced the contrast is very striking. The initial period of unconsciousness in Maclachlan's case was prolonged and complete; in Fergusson's there was none whatever. That is a symptom which is always difficult of explanation. Had the respective ages of the patients any relation to the early phenomena of concussion? Had the direction of the blow an influence in transmitting the violence more directly to the basal ganglia in the one case than the other? Was the very force and suddenness of the kick an element in diminishing shock? or was there irritation in Maclachlan's case from the depressed bone? To this last cause I attribute the fatal result. In Fergusson's case the depressed and fractured bone was at once elevated and removed; in Maclachlan's the sectio cadaveris showed that this had not been done. When he was brought to the Infirmary, it was then too late even to ascertain that such depression existed.

Doubtless the widely different symptoms of interference with nerve function depended upon the portion of the brain injured. They bear out to a certain extent the conclusions which have been drawn from recent researches, in so far as the great regions, frontal and parietal, are concerned. But they present striking anomalies. It is a remarkable fact, whether we are to explain it by duplicate action, substitution, or insignificance of function, that a considerable portion of the second frontal convolution may be destroyed without any palpable sign of its absence having been manifested during a period of three years. And not less remarkable is it in Maclachlan's case, considering the mass of evidence that has now been accumulated with reference to the localisation of function in the third frontal convolution, that to the naked eye that portion of the brain was absolutely uninjured. If, as in the case lately published by my friend Dr. Cunningham, we may have Broca's convolution destroyed without aphasia being produced; and if, on the other hand, as in this case, we may have the most complete aphasia while it remains apparently unaffected; it becomes exceedingly difficult to reconcile the ascertained facts. That such a reconciliation will be made out no one of course can doubt; but whether it is to be sought for in the double nature of the brain for the one case, and in compression or reflex action for the other, I do not venture even to discuss.

CASE OF ACUTE ASCENDING PARALYSIS.

BY ARTHUR W. FOX, M.B.

Physician to the Eastern Dispensary, and Bellott's Mineral-Water Hospital, Bath.

On March 21st, 1879, I was asked by Dr. F. Berry, the resident Medical Officer to the Eastern Dispensary, to see with him the following case:—

F., aged 26 years, a tall girl of brunette complexion, had led the life of a prostitute for the last seven years, and had been a great drinker of beer and gin; had never gone to bed sober for nearly two years; often exposed to damp and cold; five or six years ago had syphilis, history of sore, followed by eruption and sore throat. Ten months ago had a fit; was unconscious, was convulsed and foamed at the mouth. For several months she had complained of great languor and loss of appetite, and during the last six weeks those about her noticed that when she sat down in a chair she had to catch hold of something to pull herself up again. She had not menstruated for nearly two months. A week ago her present symptoms began with pains in her legs and loins; this was succeeded by incontinence of urine, and on March 30th by loss of power in her legs.

Present state.—In bed, lying on her back; pupils equal, act to light; face looked swollen, pale, and shining; tongue-edges and tip red, dorsum covered by a dry brown fur: some loss of power in both arms, more so on left side; there is complete loss of power in both legs; hyperæsthesia and hyperalgesia are also present in lower limbs—of the latter a high grade, as touching her in the gentlest manner makes her scream out, also the same on moving her legs and tickling the soles of her feet; tickling her left sole produces a slight flicker in quadriceps extensor of right thigh; the tendon reflexes appear to be abolished. She complained of pain in her back and legs of a dull heavy character. On inner aspect of both thighs are some copper-coloured spots, evidently an old syphilitic eruption; passes water involuntarily in full stream; bowels not open for four days; pulse 160; respirations 30; temperature 98.

March 22nd.—More motor paralysis of arms, attended with hyperæsthesia and hyperalgesia: the hyperæsthesia not so marked in legs; tickling right sole gives rise to slight fibrillary tremor in both thighs, more so on right side; speech affected; pulse 160; respirations 30; temperature 98.

March 23rd.—No water passed since last night, but no dulness above pubes, abdomen tympanitic; cries out when she is touched or percussed; bowels not open; pupils more dilated; tongue protruded as far as lip; speech so indistinct as to render it almost impossible to understand her; semi-delirious; no difficulty in swallowing; arms more paralysed; pulse 160; respirations 30; temperature 101.

March 24th.—Rambling delirium during night; speech much the same as yesterday, only feebler; sordes on lips and teeth; tongue covered by a dark brown dry fur, can only protrude the tip as far as the edge of lower lip; no difficulty in swallowing; condition of limbs the same as yesterday; perspires profusely; left pupil dilated oscillating; passed water yesterday evening. Specific gravity 1030, acid, ammoniacal; albumen one-sixth, brick-coloured urates; no action of bowels; pulse 160; respirations 24; temperature 99·6.

March 25th.—Dozing all the morning; face flushed of dusky hue; pupils equal, act better to light; bed-sore forming on left buttock; no other change in her symptoms; pulse 152; respirations 32; temperature 99·8.

March 26th.—In much the same condition; almost complete motor paralysis of both arms, can slightly move right wrist; motor paralysis of legs the same, also the hyperalgesia of arms, legs, and body, but there is an amount of anæsthesia; upon pinching her legs there is evidently slow conduction of the impression, as there is an interval of three seconds before she cries out; reflex excitability completely extinguished; there is no apparent atrophy of the muscles of the limbs; speech very feeble and indistinct. Her mother can understand that she complains of feeling numb all over. When I asked her if this was the case, she said "Yes." No stiffness of neck; can move her head in various directions; no action of bowels; pulse 148; respirations 30; temperature 100·4.

March 27th.—Much the same; pulse 152; respirations 32; temperature 100·4. Between 7.30 and 10.30 yesterday evening her skin was covered with a profuse perspiration, which Dr. Berry found to be of an alkaline reaction.

March 28th.—Pulse 160; respiration 32, heaving; temperature 100·2. Can speak only in a whisper; face dusky, of semi-livid tinge; left pupil larger than right. No other changes in her symptoms.

March 29th.—She died at 2 A.M.

The autopsy was made in my presence by my friend and colleague Mr. F. K. Green, assisted by Dr. Berry, on March 30th, thirty-seven hours after death.

Body well nourished; rigor mortis well marked, bed-sore on each gluteal region. The spinal cord and membranes were removed, the latter being left intact: there was no abnormal appearance in the spinal canal. Membranes of brain normal; no appearance of disease; vessels at base of brain substance appeared normal; basal ganglia, corpus striatum, and optic thalamus on each side contained some small punctiform hæmorrhages. Thorax, pericardium normal. Heart of normal size, walls soft, the finger could easily be pushed through the left ventricle; valves and orifice normal. Aorta and pulmonary artery normal. Lungs—lower lobes gorged, upper lobe of left contained a hard mass sharply defined from the surrounding lung structure; a few smaller nodules like that in left lung were found in lower portion of upper lobe on right side. Abdominal wall contained a layer of fat an inch thick. Upon the omentum and upon the abdominal wall near the spleen, and on the under-surface of diaphragm were situated numerous small semi-transparent bodies (tubercle). Liver large and fatty, a small yellowish-red nodule was situated on anterior surface of right lobe; gall-bladder, empty of bile, contained a few gritty particles. Spleen small, diffluent: pancreas normal. Kidneys of normal size, lobulated, capsules peeled well; upon section, structure of kidneys appeared congested, but otherwise normal. I submitted to my friend Dr. Shingleton Smith, for examination, the cord and its membranes, the base of brain, the mass in left lung, and the nodule on the liver. The following is the report that he has kindly furnished me with:—

"The nodule found on the surface of the liver has the structure of a small gumma which has undergone some degeneration; it appears to have grown in the wall of, and around, a small artery. You will notice a central aperture in each of the sections, but no normal arterial texture remains. The connective tissue element at the surface of liver in the neighbourhood of this nodule is in excess, but the liver cells are in a state of advanced fatty degeneration.

"The solid mass found in the lung has a fibrous structure, the air cells are entirely obliterated, little normal epithelium can be made out. Such a dense fibrillated mass can result from little else than a gummy tumour, which has been undergoing organisation for a considerable period. There is no appearance of any tuberculisation of lung, and the mass is too well defined and limited to be of inflammatory origin.

"The spinal cord did not present any abnormal naked-eye

appearance. The vessels of the pia mater were full, and there seemed to be an excess of connective tissue binding together the spinal nerves in the cauda equina. Numerous small nodules noticed on either side in the connective tissue mass were found to be healthy spinal ganglia on the roots of the nerves.

"Sections of the cord in the cervical region seem to have some increase in the connective tissue elements. The grey matter took the staining fluid more readily than usual, and some of the cells have a contracted appearance. In the lumbar region no special appearances were observed. Sections through the medulla oblongata stained very readily and deeply after short immersion in log-wood fluid, but no other appearance deserves comment. At present I can only say that the appearances are consistent with a diffuse syphilitic inflammation. No definite new growth exists in any portion of the nervous system, and no masses of leucocytes are seen in the sections; the change, if there is any, is a very diffuse one. In the absence of any other morbid change, the intense coloration is an indication of some minute and diffuse protoplasmic change, such as would exist in the early stage of diffuse myelitis."

Remarks.—Taking into consideration the very slight changes found in the cord by Dr. Smith, the case resembles in many respects those described by Landry, Kussmaul, Westphal, and others, as acute ascending paralysis. The diagnosis during life lay between acute ascending paralysis of syphilitic origin, such as Heubner describes, acute central myelitis and acute anterior polio-myelitis. The latter affection appeared to be excluded, as, according to Erb, it never attacks the medulla oblongata, whereas in the case of this woman she was unable to protrude the tip of her tongue beyond the lip, and her speech was markedly affected for at least seven days before her death. In addition to this absence of bulbar trouble in acute polio-myelitis anterior, there is neither a tendency to formation of acute bed-sore, nor are the sphincters affected to any great extent; besides, the sensibility of the skin remains intact, the disease is also ushered in with pyrexia, and is followed by rapid atrophy of the muscles of the paralysed limbs, which was certainly not appreciably present in the case of this patient. There is also a rapid loss of the faradic excitability; the latter unfortunately was not tested, as we have at present no reliable electrical apparatus at the Dispensary. On the other hand, she had certain symptoms similar to those seen in acute central myelitis, viz. the rapidly increasing failure of the reflex excitability, the formation of acute bed-sore, the

paralysis of the sphincters and the disturbance of sensibility: in this patient's case the hyperæsthesia at the commencement, and the hyperalgesia throughout, were so marked as to suggest the notion that there was probably some meningeal complication. But Erb states that in single cases of acute ascending paralysis a high grade of hyperæsthesia (hyperalgesia) of the skin has been observed. Against the diagnosis of acute central myelitis was the entire absence throughout of any convulsive movement. Erb, however, remarks that a positive diagnosis between these two diseases in many cases can only be made with the help of the autopsy, but he afterwards qualifies this statement by saying that in acute ascending paralysis no anomaly of electrical excitability worth mentioning has been found even after the disease has existed for a number of weeks, a point which constitutes a marked distinction between this form of disease and all progressive paralysis caused by gross anatomical changes within the cord, such as central myelitis and polio-myelitis anterior.

Whether this patient's case was one of genuine acute ascending paralysis, or a spinal form of syphilis which ran the course of acute ascending paralysis, like those alluded to by Heubner, it seems impossible to determine, as the symptoms noted during life, and the absence of any marked anatomical lesion in the nervous system, are common to both diseases; the only evidence in favour of the latter being the previous history of syphilis, and the appearances found in the liver and the lung.

[*Read before the Bath Pathological and Clinical Society.*]

PUNCTURE OF LENS. OPHTHALMITIS. BRAIN DISEASE. DEATH.

BY T. PRIDGIN TEALE, M.A., F.R.C.S.

Surgeon to the General Infirmary at Leeds.

THE following case, no less interesting than it proved to myself to be distressing, seems worthy of being placed on record.

In May 1867 I was consulted by Mr. J. P. I., aged 45, a celebrated Yorkshire tenor, about an increasing defect in his sight, which was seriously interfering with his profession as a singer and teacher of singing. He was myopic, and had half-formed cataracts in both eyes.

In order to economise his time I decided to accelerate the formation of the cataract in one eye, so that it might be ready for extraction during the vacation which would commence in three weeks. With this object, I slightly ruptured with two needles the anterior capsule of the left lens, in which the nuclear opacity was most advanced, rendering the eye useless. The rupture of the capsule was but slight, as it was my intention to produce slow formation of opacity of the cortical layers, with as little excitement as possible, so that he might at the same time continue to give music lessons during the three weeks which would elapse before the holidays. I name this to show how slight a rupture of the capsule it was my aim to make.

May 24th.—Puncture of lens by needles. During the afternoon the eye was more painful than is usual after such a slight operation, and the conjunctival vessels were injected.

May 25th.—Great pain. No appearance of opacity nor swelling of the lens. The *punctures in the cornea look opaque.* Some sickness during the day.

May 26th.—In the night intense vomiting, with agonising pain in the eye. During an attack of vomiting "he felt the eye go blind." At 10 A.M. I found the eye hard (Tension + 1½), the cornea dull, with opaque infiltrations (purulent) at the margin, and the pain intense. He considered the sickness

as one of his bilious attacks, to which he had been liable in spring and summer.

May 28th.—Cornea has sloughed, and the lens has escaped. For a while I hoped that the remnant of the eye would become quiescent, and that we had seen the worst in the loss of sight. Pain, however, increased, and his distress was so great that I decided to extirpate the eye.

June 4th.—The eye was extirpated.

June 5th.—Much swelling of the lids and orbital tissues.

June 7th.—Swelling almost gone. He sat up, and went downstairs.

June 8th.—Early in the morning, after a restless night, with chilliness but no rigor, he felt an intensely distressing fulness and throbbing at the back of the head on the left side, and had become aphasic, being hardly able to articulate or remember words, using wrong words, and mixing words together.

June 9th.—Improving; able to speak with tolerable distinctness.

June 10th.—The same. Pain at the side of the head. Often looks flushed. Left hand weak.

June 12th.—A convulsion.

June 13th.—Several convulsions.

June 14th.—Convulsion early in the morning; none after. He then gradually became less able to speak, more dull, but still conscious, taking very little food, and often flushed.

June 18th.—He died, with convulsive twitches of the left side, the right side being apparently paralysed, and the face slightly drawn to the left.

Post-mortem.—Dura mater was firmly adherent at several parts of the calvarium. There was very little fluid in the arachnoid cavity, and there were no adhesions of opposed surfaces of the arachnoid. There was no appearance of disease of the optic nerves, no pus about the cavernous sinus, nor at the base of the brain.

On the upper surface of the left hemisphere the arachnoid was thickened, and the subarachnoid space was filled with greenish firm lymph which looked like pus, but did not ooze out on section, and could not be displaced by pressure. Near the upper surface of the left hemisphere, rather behind the middle, there was a mass of disease involving the grey matter and centrum ovale, not invading the wall of the lateral ventricle, but situated above its roof. Both corpora striata and optic thalami were cut into without finding disease. The diseased mass consisted of a centre of the size of a small walnut of uniform chocolate tint, and in firmness like healthy brain, surrounded by a rather softer portion of brain studded with small round

black clots, the largest of the size of a large pea. The discovery of this disease, some of which clearly had not wholly arisen subsequently to the operation, led me to make inquiries, whereby the following facts were drawn out, of which I had never received the slightest hint.

About two years before this disastrous operation he jumped down from a coach with which the horses were running away, and fell, his head forcibly striking the ground. He then got up, overtook the coach, assisted with the horses, and became unconscious for several hours. After the accident he had on two or three occasions fallen from sudden unconsciousness.

The notes of the appearances in the brain were not made at the time of the post-mortem examination, but from memory shortly after.

CASE OF PSEUDO-HYPERTROPHIC SPINAL PARALYSIS OCCURRING IN AN ADULT.

BY A. HUGHES BENNETT, M.D.

THE following case is worthy of record as being an example of a disease by no means common amongst children, and which is extremely rare in the adult.

John Mill, aged 26, a hawker. The patient states that until eighteen months ago he was a perfectly healthy man. Prior to this period he had passed his life much as other persons in his class of society do. He had been to school as a boy, and at the age of seventeen he had become a gardener, which occupation he continued to practise till four years ago, when he changed his mode of living to that of a hawker. This calling he has since continued to favour with his patronage, except when occasionally required by Her Majesty's Government to pick oakum in gaol. In all these occupations, whether voluntary or forced, he never had any excessive amount of labour, and he never had any difficulty in doing an ordinary day's work.

About eighteen months ago he became afflicted with uneasy sensations in all the muscles of his body, chiefly those of the thighs, with stiffness in walking, and with rheumatic-like pains. It was then for the first time discovered that many of the muscles were enlarged. The patient states that he had not noticed this before, and was unable to say when the hypertrophy commenced. Distinct weakness of the legs soon supervened, which so increased as considerably to affect his gait. Three months later the arms became so feeble that he was unable to perform the duties to which he had been accustomed, and the limbs were found increased in size. Since then his condition has remained the same till he came under observation.

Present Condition.—A healthy-looking man. Height, 5 ft. 6½ inches; weight, 156 lbs. *Attitude.*—While sitting, finds it wearisome to remain upright, and usually prefers to recline.

While standing, places feet and legs widely apart, the pelvis is thrown forward, and the shoulders backward, so that the dorsal convexity overhangs the nates. *Muscular Conformation.*—On inspection, most of the prominent muscles of the body are found greatly enlarged, especially those of the neck, back, abdomen, thighs, and calves. The temporal and masseter muscles on both sides are enlarged, firm, and bulge outwards, so as to give a peculiar expression to the individual. The muscles of the neck are all remarkably hypertrophied, giving the patient a bull-necked appearance. The neck about its middle measures in circumference 15 inches. The tongue is larger than natural. The muscles of the chest and back are well formed, but not specially enlarged. Girt of chest below axilla is 36½ inches, at level of nipples 37 inches. The deltoids are well developed, so also are the muscles of the upper and fore arms, neither of which are larger than those of a healthy working man. The measurements are:

	Right.		Left.
Upper arm at axilla, when extended	10½ in.	..	10⅝ in.
„ when flexed	11	..	10⅝
Upper arm at middle, when extended	10½	..	10⅝
„ when flexed	11	..	11¼
Upper arm above elbow, when extended	8½ in.	..	8½ in.
„ when flexed	9¼	..	9¼
Fore arm below elbow	10	..	10
„ at middle	8½	..	9
„ above wrist	6½	..	6½

The muscles of the abdomen and lumbar regions are considerably enlarged and prominent, so as in the latter to leave a deep sulcus in the spinal line. The girth at level of umbilicus is 33 inches. The glutei on both sides are very greatly enlarged, the circumference, when both legs are together, being 37½ inches. The muscles of both thighs also are very much hypertrophied, the measurements being:

	Right.		Left.
Thigh at level of great trochanter	22¼ in.	..	22¼ in.
„ at middle	22	..	22
„ above knee	19	..	19

The muscles of the calf of the leg on both sides are very much enlarged, the measurements being:

	Right.		Left.
Calf at thickest part, flexed	15⅝ in.	..	15½ in.
„ extended	15¼	..	14¾
Above ankle joint.	7½	..	7½

All the other muscles of the body, except those especially described as enlarged, seemed to be abnormally small, the two being in striking contrast. The hypertrophied muscles were firm, dense, and hard to the feel, and this was further increased

when attempts at flexion were made. The faradic and galvanic currents being applied, the muscles contracted feebly, but far short of normal action. An effort was made to induce the patient to permit a portion of his muscle to be submitted to microscopical examination, but his thirst for scientific research was so feeble as to be overcome by the fear of the small operation necessary for the purpose. *Sensibility.*—Functions of brain normal, with exception of occasional pain in the vertex. Has a feeling of formication, and a pricking sensation in the thighs. He has also a peculiar twitching feeling in the muscles. Has no dorsal or other pain. Sensibility in other respects normal. *Reflex Motion.*—Normal. *Voluntary Motion.*—In almost exact proportion to the increased size of the muscles is their strength and power of movement impaired. The movements of the tongue are sluggish, and can only be performed slowly and deliberately. The patient has difficulty in commencing to speak, but having once begun can articulate fairly well. The muscles of the jaws and face act slowly and feebly, so also do those of the head and neck. Movements of the chest appear normal. The upper extremities can be moved freely in all directions, and there is everywhere perfect power of co-ordination. Considering the size of the muscles, there is great want of power, the movements of the limbs being slow, feeble, but steady. The grasp of the hand is weak, the right the most so, although formerly the patient was not left-handed. A pin can be taken up accurately, but cannot be used neatly. The lower extremities are both extremely weak. The patient walks with much difficulty, with a feeble, waddling gait, swaying from side to side, and with his legs wide apart. He finds it almost impossible to go up-stairs; rises from the sitting position with much difficulty, having to assist himself with his arms. When he lies on his back he can move his legs in all directions, but slowly and imperfectly. *The Special Senses* were normal, with the exception of the right eye, the sight of which was greatly diminished, and the condition of which was as follows: $S = \frac{1}{6}$; the retinal vessels small; pigment spots in neighbourhood of optic disc; otherwise normal. The other systems of the body were normal.

Remarks.—Few observations are necessary in a case such as this, the facts of which speak for themselves. The chief feature of interest is the extreme rarity of pseudo-hypertrophic paralysis attacking an adult, this disease being as a rule almost entirely confined to children. In eighty cases cited by Eulenburg, only five commenced after adult life. Another point of great rarity is the extensive distribution of the disease, especially to the muscles of the neck, jaw, and tongue.

At first sight it may appear, in reference to the preceding measurements of the limbs, that they do not much exceed those of an ordinary well-developed man. But it must be remembered that the patient was short, evidently by nature of a slight and rather spare build, and whose original muscular conformation had been anything but highly developed. Inspection of the case made this very apparent, as there was so striking a contrast between the hypertrophied muscles and those unaffected, the former standing out prominently dense and hard, forming a deformity when compared with the non-affected muscles, and the small and slight osseous conformation. Taking the leg as an example, there was a small and almost delicate foot sparingly clothed with muscles, a thin ankle only measuring $7\frac{1}{2}$ inches in circumference; and suddenly the mass of the gastrocnemus and soleus bulging out, being in girth $15\frac{3}{4}$ inches, and then at the knee-joint the rapid decrease in size to a small and almost fleshless articulation. The deformity thus occasioned, together with the marked increase in size of the muscles, were more readily appreciated at the time than can now be described. The difference was also well marked in the face, which was, as a whole, thin and pinched-looking, with the mass of the temporals and masseters abnormally developed.

As has been already pointed out, exactly in proportion as the various muscles were increased in bulk, so was their vigour and power diminished, thus distinguishing this affection from true hypertrophy.

It is unfortunate that this patient's views of public morality were of so elastic a character, as not only had they previously subjected him to censure by the state, but compelled us summarily to eject him from the hospital after a few days' observation.

CASE OF ACUTE TRAUMATIC TETANUS.

BY SURGEON-MAJOR J. J. L. RATTON, M.D., M.C.

Madras Medical College.

LUTCHMOO, aged 30 years, a married Hindoo woman, was admitted to the Hospital for Women and Children, Madras, on the 10th of May, 1879, with the following history.

History.—Two days before admission, that being the third and last day of a menstrual period, she took a cold bath. Next day symptoms of lock-jaw appeared, and the day after she sought admission to hospital.

May 10th. State on Admission.—The patient is a strong, well-developed woman. The muscles of her neck and abdomen are hard and contracted. Trismus is established, the mouth cannot be opened more than half an inch. She has occasional slight spasms of opisthotonos. She can swallow without much difficulty. The left ankle is disfigured with deep syphilitic ulcers, some with sinuses and tense cicatricial bands. Pulse 136. Temperature 102°·2 F. Respiration 30.

Treatment.—The cicatrices and sinuses were slit up to relieve tension, and a poultice smeared with belladonna ungt. was applied over the ankle. Calomel grs. v. and pulv. jalapæ grs. 30 at once. Chloral hydrate ʒss in syrup every two hours.

May 11th.—Patient's bowels have been moved, and she has taken 300 grs. of chloral. Trismus is further developed, and there is great difficulty in swallowing. The spasms of opisthotonos are decided, and occur about every hour. Patient is well under the influence of chloral, but not completely so. Evening temperature 103° F. Pulse 140. Respiration 32.

Treatment.—Continue chloral ʒss every two hours by the mouth as long as a patient can swallow, afterwards by the rectum. Strong beef-tea every three hours, by mouth or rectum.

May 12th.—Decidedly worse. Although completely under the influence of chloral, the tetanic spasms are excited by the least noise or motion. The body is arched forwards, the head

thrown back; every muscle of the trunk and extremities is firmly set; the teeth are clenched, and the patient remains thus, breathless, as if cast in iron, for sixty seconds or so. There is no mistaking the acute nature of the case. Evening temperature 102°·8 F. Pulse 136. Respiration 32. Nutrient and chloral enemata had been required for the past eighteen hours. Three hundred grains of chloral used.

Seeing that the patient was worse even with the very free exhibition of chloral adopted, I decided to give nerve-stretching a trial. The operation was performed at once.

Operation.—Under chloroform, and with the carbolic spray, an oblique incision was made in the left ham downwards, from the lower border of the gluteus maximus. There was some difficulty in finding the sciatic nerve, which was covered by 2½ inches of fat, and overlapped by muscle. When found it was drawn out of the wound and stretched with a force of about 30 lbs.[1] for the space of two minutes, and afterwards jerked once or twice with about double that force before being replaced. Silk sutures and boracic dressing.

After the Operation.—Not a single spasm occurred during the rest of this day for fourteen hours after the operation.

May 13th.—Patient well under the influence of chloral, but very restless, tossing from side to side. Slight spasms of opisthotonos appear to occur at intervals. Has had 300 grs. of chloral by the rectum since the operation. Temperature 102°·5 F. Pulse 144. Respiration 32.

May 14th.—The spasms have ceased altogether. Patient is quite under the influence of chloral, but can be roused to take nourishment, which she begins to swallow. Has taken 270 grs. chloral diet at this time. Beef-tea, 4 pts. (concentrated); milk, 4 pts.; eggs, 4; arrack, 6 ounces, by mouth and rectum.

Treatment.—Cont. chloral ʒss every three hours. Evening temperature 102°·5 F. Pulse 130. Respiration 36.

May 15th.—No spasms; under the influence of chloral yet. Very restless. Has taken 180 grs. chloral by the mouth. Sciatic wound begins to suppurate. Temperature, evening, 102°·2. Pulse 136. Respiration 34.

May 17th.—Still chloralised. Not so restless. Muscular tension continues, but no spasms. Reduced chloral to ʒss every fourth hour. Temperature 102° F. Pulse 120. Respiration 30.

May 19th.—Improving. Trismus diminishing. Takes 120 grs. chloral daily. Not so restless. Temperature fell to normal this day, and continued so for the rest of the case. Pulse 120.

[1] The force required to lift a 3 lb. weight.

May 22nd.—Doing well. Passed a round worm by the mouth. Ordered santonine grs. v, followed by a purge. Bowels opened three times; no worms. Ordered chloral ʒss three times a day.

May 29th.—Can open her mouth about halfway. Can speak distinctly. Begins to masticate, and is ordered full diet at her own request. Neck and abdominal muscles still tense. Continue chloral ʒss twice daily. Sciatic wound healthy suppurating and dressed from the bottom.

June 1st.—Still improving. Chloral ʒss at bed time.

June 23rd.—Patient is able to sit up. Tetanus quite gone. Sciatic wound healing. Tried her again with santonine, but found no worms. Sensation, nutrition, and power equal in both limbs.

Remarks.—Notwithstanding the fact that a chill after bathing at the end of a menstrual period was the exciting cause of the attack, I think all will agree that the above case was one of traumatic tetanus. To those who would call it puerperal, I may suggest that traumatism is concerned in the origin of puerperal tetanus. This woman had never borne children. She was strong, stout, and in the prime of life. Although well saturated with chloral, the symptoms rapidly developed into an explosion of acute tetanic violence, which would surely have carried the patient off but for the nerve-stretching. At the same time, nerve-stretching would not have saved the patient but for the chloral. Eighteen hours after the operation slight spasms reappeared, and if at this time chloral had not been pressed, I fear the spasms would have gathered strength. The day after the operation I left instructions at the hospital to send for me if clearly marked spasms of opisthotonos returned, as I intended to have opened the wound and stretched the nerve again. This is the fifth time that I have stretched the sciatic for traumatic tetanus, and each time the separation has suppressed spasm for many hours. If during these valuable hours of rest chloral is properly plied, the chances are that spasm will not return. I have been obliged to give chloral very freely, and to maintain narcotism for about ten days. During the three critical days, on and after the operation day, the patient had 300 grs. chloral daily. The absolute fatality of acute tetanus justifies the exhibition of the drug in what appears to be a reckless fashion. There is besides an astonishing toleration of chloral. The sciatic wound suppurated freely, but there was no pain complained of in the limb, and there was no contraction of it. In this case I purposely refrained from operating until the symptoms were alarming, for I wished to test the value of nerve-stretching in

acute cases only. Sub-acute cases get well of themselves. Really acute cases, I believe, never get well of themselves. It would be well whilst this treatment is on its trial to wait for an outburst of acute symptoms before operating. We shall then sooner know the value of the remedy than if it is used indiscriminately, or before it is quite certain that the case is going to be acute. I doubt if any treatment will avail to cure acute tetanus, unless age and stamina are with the physician. I mean by age, about thirty years, the prime of life. In this case the duration of the disease was twenty-three days. It is seldom less in acute cases. Only the strong can hope to battle through the exhausting efforts of clonic and tonic tetanic spasms prolonged for days, generally with insufficient nourishment, often, for days at a time, with rectal alimentation only. Yet, considering the well-merited reputation of tetanus as a fatal disease, it seems to me a solid gain that even a few cases may in certain circumstances be saved by modern medicine.

Abstracts of British and Foreign Journals.

Report on Visceral Neurology. "Trophic Nerves."—In this Report for January (see Vol. I. p. 581) an account was given at some length of the experiments of Steiner upon the effects of section of the cervical vagi on the nutrition of the lungs. Steiner confirmed Traube's view, that the pneumonia that follows this operation is traumatic and not trophic in its nature, and is proximately due to paralysis of the pharynx, larynx, and associated parts. Michaelson has studied the same subject (*Centblt.* 1879, No. 22, p. 390), separating as far as possible the influence of the superior laryngeal from that of the vagus proper. He concludes that the changes in the lung consequent on section of the vagus proper are immediate; that they affect chiefly the lower and middle lobes; and that they are of the nature of œdema, hyperæmia, and splenization, with hæmorrhage and emphysema. By direct inspection Michaelson observed within a few minutes after section, an elevation of temperature in the lungs to the amount of ·25 C.; and redness of the pulmonary tissue, which reached its height in half an hour, and then became complicated with hæmorrhage. On the other hand, the changes that follow section of the two recurrent nerves are chiefly located in the upper parts of the lungs; consist of a catarrhal pneumonia, which generally becomes caseous; and do not make their appearance until the laryngeal paralysis has exerted its injurious influence for a sufficient length of time. Michaelson concludes that the vagus contains vaso-motor fibres for the lungs.

It may be remembered that in the paper referred to above, Steiner attributed the death of the animals experimented on in this way to the inflammation of the lungs. A remarkable amount of attention appears to have been recently devoted in Germany to the subject of vagotomy, and an active controversy has been maintained between several observers on the point just mentioned.

Eichhorst, in a special work (reviewed in the *Centblt.* 1879, No. 10, p. 181), refers the death of the animals (birds) after section of both vagi to cardiac paralysis from fatty degeneration of the myocardium, which he considers a purely trophic lesion. This author therefore concludes that the vagus contains trophic fibres to the heart. Thus the question of the trophic function of the vagus, which seemed to be settled in the negative as regards the lungs, is now reopened on fresh ground, namely, as regards the heart. Zander of Königsberg opposes Eichhorst's view, and states (*Centblt.* 1879, No. 6, p. 99; and No. 7, p. 115) as the result of more than eighty experiments on birds, that the cause of death after vagotomy is starvation, with which fatty degeneration of the heart and cardiac failure are associated as *effects*. The latter point is confirmed by Wassiljew (*Centblt.* 1879, No. 21, p. 382); who, however, in a subsequent contribution (*Ib.*, No. 27, p. 494) states that injury to the cervical vagi in a rabbit produced after the lapse of several months fatty degeneration of the heart. Zander's position is however much more seriously assailed by Eichhorst, who contends in reply (*Centblt.* 1879, No. 10, p. 161) that in animals dying of starvation the change in the muscular tissue of the heart is not true fatty degeneration (such as is found after vagotomy) but a granular dulness—the *trübe Schwellung* of Virchow, which Zander had probably mistaken for the former lesion. Eichhorst maintains, therefore, that, after double vagotomy, birds die not of inanition, but of acute fatty degeneration of the heart, of trophic origin.

A subject which is closely related to the preceding is the localisation of acute disease of the respiratory organs in hemiplegia, to which Rosenbach has drawn attention. (*Centblt.* 1879, No. 16, p. 282.) This author believes as the result of his observations that the paralysed side is much more frequently than the sound side the seat of acute lung-disease. In searching for an explanation of this striking observation, Rosenbach found that both the direct and the reflex irritability of the involuntary muscular tissue of the paralysed side is decidedly lowered. One result of this condition will be that foreign matter (saliva), entering the bronchi of the corresponding side, will not give rise to sufficient expulsive efforts; and that unilateral broncho-pneumonia will be set up. The author withholds any explanation of the occurrence of croupous pneumonia and pleurisy under the same circumstances.

Professor Hagen has contributed to the subject of trophic lesions, the results of experiments upon the effect of section of the trunk,

of the fifth nerve within the skull, on the condition of the mucous membrane of the tympanum (*Archiv f. Experim. Path. und Pharm.* xi., 1 & 2, p. 39). These results are, however, as various and conflicting as the conclusions that have been previously drawn from similar experiments connected with the cornea; so that the question of the effect of lesion of the trigeminus on the nutrition of the parts that it supplies appears to be as far from being settled as before. Gellé had concluded (*Gaz. Méd. de Paris*, 1878, No. 1) from a single experiment on a dog, that the trigeminus contains trophic nerves to the mucosa of the middle ear, inasmuch as a lesion of the medulla oblongata involving the root of the fifth nerve was followed not only by inflammation of the eye and nose, but by suppuration of the corresponding tympanum, the animal having lived about ten days. Professor Hagen repeated this experiment upon thirteen animals, but instead of injuring the medulla, cut the trigeminus on one or both sides without opening the skull. In eleven of the cases not a trace of exudation was present in the tympanum. In the remaining two cases exudation was found after twelve hours and thirty-one hours respectively. In one of them there was also abundant sero-sanguinolent non-purulent fluid within the *opposite* tympanum—an appearance which Hagen (perhaps somewhat hastily) considers a proof that the inflammation was not on either side to be regarded as a trophic lesion. The presence of exudation in the second case he explains as accidental, and due to other causes (!). In one of the "negative" cases, although no "exudation" was present, there was found when the animal was killed, some sixty days after section of the right trigeminus, a perforation of the membrana tympani, which was stopped by a whitish-yellow tallowy mass. When these results are considered, it is somewhat surprising to find that Hagen concludes that the integrity of the tympanum after section of the trigeminus conduces to "completely support the traumatic nature of 'trigeminus-keratitis.'"

A case of joint-change in consequence of lesion of the nerves of the hand is reported by Bouchut, who considers it "trophic" in origin. A child which had the distal phalanx of the right thumb crushed at the point six years previously, presented, at the age of 7, atrophy of the muscles and bones of the right forearm and hand; pains in the joints of the hand and fingers; and knobby prominences on the distal joints of *both* hands (*Centblt.* 1879, No. 12, p. 224).

The Heart.—The attempts to discover a "centre" for the heart in the cerebral convolutions, that is, a point or region which could

be proved by faradisation to influence the cardiac rhythm, have not been successful in the hands of Eckhard (*Centblt. f. d. m. W.*, 1878, No. 34, p. 611). In non-curarised animals, faradisation of the cortex cerebri produces, as a rule, no effect upon the beat of the heart, so long as there are no sudden movements of the body. If sudden movements occur, whether from direct irritation of the so-called "motor" centres or from other excitation, then the heart and circulation may be affected. The rule is that no cardiac disturbance can be discovered as long as only single movements of the opposite anterior extremity are induced. If other movements occur, the pulse becomes less frequent and stronger (with weaker beats between), and that through the medium of the vagus. At the same time the blood-pressure rises somewhat, and that independently of the heart. Irritation of the *cornu ammonis* was found to have no influence on the cardiac movements, such as Balogh has described, so long as no muscular movements were induced.

Ludwig (of Pontresina) and Luchsinger publish (*Centblt.* 1879, No. 23, p. 404) the results of their researches on several points connected with the innervation of the heart, and especially with reference to the activity of the intracardiac ganglia. They find that the ganglia are paralysed by high temperatures, while their irritability is again restored on cooling. Just before the onset of paralysis, and again as soon as the impulse is restored, the vagus is irritable to a high degree. The inhibitory elements of the heart are therefore more resistant to heat than the motor elements are. The activity of the vagus falls as the intracardiac pressure rises, for the excitation of the motor elements increases with the pressure. Therewith also rises the frequency of the pulse; and this both as regards the heart as a whole, and portions of the heart artificially separated.

The Vagus.—The view of Arloing, Tripier, and Masoin, that the heart is more powerfully affected through the right vagus than it is through the left, that is, that the right vagus essentially contains cardiac fibres (whilst the left vagus essentially contains respiratory fibres), has not been confirmed by Langendorff (*Centblt.* 1879, No. 23, p. 406). The truth appears to be that the results obtained from galvanisation of both nerves are extremely variable.

A case of exceedingly frequent pulse (136–148 per minute, persistently) is recorded by Meixner (*Centblt.* 1879, No. 31, p. 573), in which the left vagus was found *post mortem* to be compressed by an enlarged and cheesy lymphatic gland.

The subject of vagotomy has been discussed above under "*Trophic nerves.*"

Vaso-motor Centres and Nerves.—The view that is held by some physiologists that dilatation of the blood-vessels may be brought about by vaso-dilator nerves connected with vaso-dilator centres in the spinal cord, is supported by certain experiments of Dr. Ott of Baltimore (*Journ. of Physiol.* II. i. p. 51). He has determined that in the cat a centre of the vaso-dilator nerves for the skin of the posterior extremities is located between the tenth dorsal and the first lumbar vertebræ.

Jolyet (*Gaz. Méd.* 1878, No. 46) has found by experiments on curarised dogs that faradisation of the trunk of the superior maxillary branch of the fifth nerve of one side in the pharyngo-maxillary fossa, causes active hyperæmia, with elevation of temperature of the mucosa of the nasal fossæ and of the gums; of the mucosa and skin of the upper and lower lip; and of the skin of the ala of the nose of the same side. These effects are not produced if the vago-sympathetic trunk of the same side have been previously cut. Further, section of the superior maxillary is followed by slight hyperæmia of the above-mentioned parts, which is reduced by irritation of the peripheral end of the divided nerve. According to Jolyet, these results indicate that the vasor dilatation in the parts is due to reflex paralysis, through the trigeminus, of vaso-motor nerves contained in the sympathetic. This view is supported by the fact that faradisation of the superior maxillary of one side (with, as well as without, section of the corresponding sympathetic in the neck) also produces similar hyperæmia of the skin and mucosa of the opposite side, though to a less degree.

Vaso-motor fibres to the lungs are referred to under the head of "*Trophic nerves.*"

Respiration.—The histological characters of the nerves of the lung in the frog and calf have been investigated by Egorow, working under Chrzonszczewsky. In the frog, the great bulk of the nerve fibres entering the lungs are non-medullated. The trunks of these are provided with abundant ganglia, the cells of which mostly present the well-known "spiral fibres" of Beale. The medullated fibres enter the muscles of the alveolar septa; lose their medullary sheath; and, forming a network, end in the muscular fibres. The non-medullated fibres breaking up into fine and finer networks; end in the sub-epithelial muscular layers of the alveoli; and extend into the pleura. The vessels are supplied by the non-medullated fibres (*Centblt.* 1879, No. 18, p. 305).

Langendorff appears to have succeeded beyond other observers in obtaining experimental evidence of the existence of "expiratory," or "inhibitory" or "slowing" fibres to the respiratory centre, in the trunk of the vagus (*Centblt.* 1879, No, 21, p. 375). While Rosenthal and others found that a strong current applied to the central ends of the divided vagi causes acceleration of respiration, with finally tetanus of the diaphragm (extreme inspiration), and only occasionally slowing of respiration and arrest in expiration, Langendorff observed expiratory almost as often as inspiratory standstill. Mechanical and thermic stimuli in the same way caused respiratory slowing; which was even more pronounced by chemical irritation. No support was found for the view that inspiratory and expiratory fibres run chiefly in the one and in the other vagus respectively; nor for the view that the left vagus contains chiefly respiratory fibres (and the right vagus chiefly cardiac fibres). Langendorff also concludes that the respiratory centre is double, from the fact that acceleration of respiration may be induced by stimulation of one vagus after exhaustion of the other vagus by protracted stimulation. Finally, this observer believes from his experiments that the slowing and accelerating influence on the respiration of irritation of the vagus is not peculiar to this nerve; but that many, and probably all sensory nerves possess this property, slight excitation accelerating the breathing, and powerful excitation slowing it.

Perspiratory Centres.—Dr. Ott in his investigations upon the physiology of the spinal cord (*Journ. of Physiol.* II. i., p. 51) endeavoured to localise the "perspiratory centre" of the hind foot (in the kitten); and confirms the view of Luchsinger that it is situated in the lower dorsal part of the spinal cord, whence the nerves pass to the limbs through the abdominal sympathetic and sciatic trunks. The sweat-nerves of the anterior extremity appear to emerge from the cord in the fourth dorsal nerve, and to pass through the stellate (or first thoracic) ganglion to the brachial plexus. Thus in both extremities the secretory nerves appear to follow closely the course of the vaso-motor fibres. Sweat-centres, like vaso-motor centres, are also situated throughout the cord and medulla oblongata; for irritation of the latter causes abundant perspiration in all the extremities. An inhibitory sweat mechanism also appears to exist, and to be partly peripheral (multipolar nerve-cells in the glands,) and partly central—the fibres to the lower limbs running in the sciatic and abdominal sympathetic from the cord, and perhaps from the medulla.

Dr. Ott also found that the stimulant effect of asphyxia, i.e. of excess of carbonic acid in the blood, upon the sweat-glands, is exerted through the centres in the cord. The same applies to the stimulant effect of heat upon the perspiratory glands, which is not direct but central. On the other hand, pilocarpin appears to excite perspiration through a peripheral mechanism; and muscarin by direct stimulation of the secreting cells.

With respect to the *path* of the perspiratory fibres in the spinal cord between the lower extremity of the dorsal region and the medulla oblongata in the cat, Ott confirms the results of previous observers in the rabbit; namely, that the secretory fibres connecting the sweat-centres with each other run in the lateral columns, at least in the dorsal portion of the cord, about the sixth and seventh vertebræ. The sweat-fibres appear not to decussate in the case of the cat.

Innervation of the Pelvic Viscera.—Dr. Ott (*loc. cit.*) determined several points of interest with respect to the rhythmical contraction of the sphincter ani under nervous excitation, and discovered a similar rhythmical contraction of the sphincter vaginæ. The ano-spinal and vagino-spinal centres were determined to lie together between the sixth and seventh lumbar vertebræ. He made the further observation that irritation of the vaginal or rectal mucosa may induce rhythmical adduction and extension of the voluntary muscles of the posterior extremity of one side. The *vesico*-spinal centre is placed by Dr. Ott (as by Kupressow) between the fifth and sixth lumbar vertebræ (cat and rabbit). The *thalami optici* were proved to contain in part at least the centres of the inhibitory apparatus presiding over the ano-spinal and vagino-spinal centres, and restraining their rhythmical action.

Liver and Pancreas.—In Zander's experiments upon the effects of section of the vagi, described above, the observation was made that the liver continued to secrete abundance of bile, and that the pancreas was most probably also active. Glycogen and sugar disappeared very soon after the operation. It must not be forgotten, in estimating the significance of these results, that the animals (birds) were dying of inanition from complete paralysis of the œsophagus.

J. Mitchell Bruce.

Locomotor Ataxy, and its Connection with Injuries. (*Revue Mensuelle de Médecine et de Chirurgie*, No. 3, 1879.)—Dr. L. H. Petit endeavours in this paper to throw light on the in-

fluence which traumatic lesions have on the origin or course of locomotor ataxy. It will readily be conceded that he gave himself a somewhat difficult task, for the records of cases have been so often meagre and uncertain as to make them more or less unsuited as reliable data for inquiry. Few questions, indeed, are less easy to decide than the influence of injuries in giving rise to slowly progressive diseases of the nervous system. The insidious appearance of the symptoms, and the often long duration of those which are less obvious and which may have been at first transitory and occasional, render it impossible perhaps to say when the particular disease had a beginning. An accident, or an acute illness, may have been the one thing needed to upset a balance which had hitherto been maintained, and to reveal conditions hitherto unsuspected or unobserved. Examples of this are met with every day in diseases where the nervous system plays but little part, and if mistakes are made in simpler cases, how much more readily may error arise as to the causation of those diseases of the central nervous system itself, whose earliest manifestations are hidden and obscure! And more especially may this be said of locomotor ataxy.

For the purposes of his inquiry M. Petit gathers together a large number of cases from French, German, English, and other writers, and his long and cautious essay is a valuable contribution to the study of an important subject. Viewed, however, with no undue scepticism, we cannot but think that grave doubts must rest upon much of the evidence which many of the cases appear to show, and that the *post* and the *propter* have often been confounded.

To take the first case recorded in 1844 (W. Horn, *in* Steinthal, *Journal de Hufeland*) we read as follows: "Man, aged 37. Fall from horse; unconscious several hours. No morbid symptoms afterwards; but, in the winter following, onset of pains and cramps in the lower limbs; after that numbness in the legs, gait uncertain and tottering; dysuria with incontinence. Horn diagnosed a *tabes dorsalis* of traumatic origin. Bleeding and strychnia without result." A history like this, and it is neither more nor less precise than many histories in the paper, is inadequate, we think, for the foundation of any very decided opinion, notwithstanding the fact that Steinthal, who gives the case in his paper, "Beiträge zur Geschichte und Pathologie der Tabes dorsalis," attached great importance to the traumatic origin of the *tabes* in this particular instance. True, the author himself seems to entertain much the

same objections to his collected matter, for he writes that the evidence therefrom is hardly sufficient to warrant any precise conclusions, and he would rather point out the channels in which further inquiry may fitly flow. Better than by searching medical literature for imperfect records in the past, let greater care be bestowed on the observation and record of future cases, remembering that here, at least, conjectural statements must not fill up gaps in evidence, if there is to be a right estimate of the weighty matters which pertain to the history of disease.

In addition to the influence of injuries in the production of locomotor ataxy, M. Petit examines that of traumatic lesions, accidental or other, upon the course of the already existing disease; the influence upon it also of intercurrent febrile affections, e. g. pleurisy and erysipelas; and finally, the influence of locomotor ataxy itself upon the progress of traumatic lesions.

Here it must suffice to give the conclusions at which the author has provisionally arrived. Direct or indirect injuries of the spinal column, falls on the back, the buttocks, or the feet, give rise to shake of the spinal cord, and in consequence thereof to lesions which may become the starting-point of chronic myelitis, and induce the symptoms of locomotor ataxy. It is impossible so far to affirm that injuries of other and distant parts have the same pathogenic influence, although it is probable that in persons predisposed to general sclerosis, the arthritic, the syphilitic, the alcoholic, such injuries may, by irritation of the spinal marrow, hasten the development of ataxy. Injuries of this nature can certainly revive an ataxy apparently cured, or hurry on the course of one already existing; while various morbid actions, the suppression of habitual secretions or discharges, of hæmorrhoidal or catamenial flow, or of cutaneous eruptions, pregnancy, and intercurrent febrile affections, seem to act in a like manner.

Ataxic symptoms may be localised in some regions or organs affected either before or after the appearance of ataxy. In some instances prolonged peripheral irritation has given rise to nervous phenomena which have been wrongly described as locomotor ataxy, and which have disappeared with removal of the cause. Associated as locomotor ataxy often is with derangements in the nutrition of certain tissues, it can modify the course and progress of local lesions, an observation pointed by the consideration of cases of contused joints, fractures, and laceration of soft parts.

HERBERT W. PAGE.

Cases of Bulbar Paralysis. Prof. W. Erb (*Archiv für Psychiatrie*, vol. ix. Pt. II.).—The interest and importance of the electrical reactions of nerve and muscle in various diseases are becoming daily more evident, though the ridiculously inadequate methods of investigation prevalent among us still prevent electro-diagnosis from occupying the position it deserves. The first case presented by the author forms the theme of some important remarks upon the electrical irritability in bulbar paralysis. He had already propounded his views in Ziemssen's Cyclopedia (vol. xi.); but here he adduces a body of confirmatory evidence. Clinical facts, as well as experimental, have shown that *qualitative* changes in electro-muscular reaction occur only in such lesions where we must assume an interference in the "trophic" influence of the cord upon the nerves and muscles. Such changes are observed in their full perfection in cases of "severe" facial paralysis, or of traumatic paralysis of various nerves. But in these cases the nerve itself is always found to have undergone change, and lost its electrical irritability. Now in bulbar paralysis, and in a whole series of cases such as poliomyelitis, progressive muscular atrophy, &c., it is sometimes found that the muscles present the characteristic reactions of degenerative changes, whilst the nerves (at least during the earlier period of the disease) react normally or almost normally to both currents.[1]

Prof. Erb draws attention in the same case to the phenomenon of increased reflex in the facial muscles, which responded readily to slight stimulation of the superjacent skin, the nose and the eye.

The second part of the paper describes a case which presented, in addition to well-marked bulbar symptoms, phenomena of paresis and pain in the extremities, double vision, intense headache, noises

[1] In the 'British Medical Journal' (May 31st, p. 837) an editorial note appended to a letter of mine objects that the cases are yet too few to prove that this modified form of degenerative reaction necessarily points to a *central* disease. But, first, what is claimed for it is simply that it points to a "spinal" paralysis in Marshal Hall's sense. Secondly, the objector forgets that in this modified form there occur qualitative as well as quantitative disturbances in the muscular reactions: a phenomenon absolutely unknown in purely local muscular disease.

Recently I had an opportunity of diagnosing a case of progressive muscular atrophy, and one of polio-myelitis anterior chronica in their incipient stages, in which only local disease was supposed to exist. The further progress of the cases justified the diagnosis. I have now under observation a case of bulbar paralysis where the lip muscles present the reaction of A C C > K C C (both diminished) with almost normal nervous irritability.

in the ears, weakness of the masticatory and cervical muscles, &c., and which against all expectation made a fair recovery after a course of galvanic applications to the head and neck. The marked influence of the very first sittings leaves no room to doubt the efficacy of the treatment.

The third part treats of a new, and probably bulbar, "symptomen complex." Under this heading three cases are described in which the leading symptoms were (1) Ptosis; (2) Paresis of the muscles of the back of the neck; (3) Paresis of the masticatory muscles.

The development of these symptoms took place in a few months, accompanied with pain in the neck and head, and with vertigo in two cases. There was also weakness of the extremities and of the tongue, but no change in the lower half of the face; whilst in two cases the upper half was slightly paretic with increased irritability. Other symptoms occurred in the three cases severally, interesting but not sufficient to veil their fundamental unity.

One of the patients died rather suddenly. Unfortunately she had left the hospital, and no autopsy was made.

Conclusions from the Study of 125 Cases of Writers' Cramp and Allied Affections. Dr. G. M. Beard (*New York Medical Record*, March 15, 1879).—In this paper the author gives a summary of what will form the subject of an ulterior publication.

1. The name of the disease is a misnomer; often cramp occurs only late (sometimes never) in the progress of the complaint. Among the numerous other symptoms which characterise it are: fatigue, aching pain, nervousness, trembling, stiffness, paresis or paralysis, numbness and numerous other subjective sensations, abnormal grasp of the penholder, &c. These symptoms often extend beyond the hand and arm.

2. In other professional "cramps," such as that of musicians, telegraphists, painters, dancers, blacksmiths, barbers, &c., no *one* symptom is diagnostic.

3. The author's view of the pathology is that the disease is primarily of peripheral origin; secondarily and rarely it becomes central.

4. Writers' cramp occurs chiefly in those whose constitution is vigorous. In the nervous it is less common, and then is more easily relieved.

5. It occurs rather in consequence of routine work (copyists, &c.) than of work implying thought (authors, &c.).

6. It is no longer an incurable disease. The chief agents in its treatment are galvanism and subcutaneous injections of atropia, strychnia, duboisia, arsenic (pushed to their physiological effects). To these may be added massage, blisters, cautery; and internally calabar bean, ergotine, iodoform with nerve foods.

The author describes a number of devices by which the symptoms may be palliated, chiefly modifications in the making or holding the pen.—Some observations on the speed of handwriting are appended, and the paper concludes with some remarks on telegraphers' and musicians' cramp.

A. DE WATTEVILLE.

Dimensions of the Fœtal Head. (*Gazette des Hôpitaux*, *No.* 89, *July* 15, 1879.)—At the Société de Biologie, MM. Budin and Ribement have given the results of their observations of 211 cases. The heads of that number of infants at the age of 40 to 72 hours have been minutely examined, for then the cranium, deformed by the pressure of parturition, had returned as nearly as possible to the fœtal condition.

These measurements were soon found to vary with the weight of the infant; it was therefore necessary to study these points in connection. And having had to distinguish two series (male and female), each series has been divided into six classes.

				Gr.		Gr.
Class A.	Infants	weighing	from	1500	to	2000
„ B.	„	„	„	2000	„	2500
„ C.	„	„	„	2500	„	3000
„ D.	„	„	„	3000	„	3500
„ E.	„	„	„	3500	„	4000
„ F.	„	„	„	4000	„	4500

Class D. (gr. 3000 to 3500) may be considered as "normal," and the results of measurements of males and females coming within it are subjoined.

1. Maximum diameter, chin to farthest point of cranium on the sagittal suture, 13½ c.

2. Occipito-mental diameter, 13 c.

3. Occipito-frontal diameter (root of nose), 11¾ c.

4. Diameter from the point of meeting of the occipital with the neck to the middle of the great fontanelle, at the level of the point where the sagittal and parieto-frontal sutures cross, 10 c.

5. Biparietal diameter, or greatest width posteriorly, 9½ c.

6. Bitemporal diameter, or least width anteriorly; from the rise of the parieto-frontal suture on one side to that of the other, 8¼ c.

7. Bimastoid diameter, 7¾ c.

Greatest circumference at the plane of the greatest antero-posterior diameter, 38 c. 12. A smaller circumference on the plane of number 4, 32 c.

In comparing the figures obtained in the different series, MM. Budin and Ribement have found that the diameters are increased in proportion to the weight of the fœtus, that it is not the sex but the weight that causes variation in the size of the head.

The length of the body increases with the total weight of the infant. They also found with regard to the male infants the figures 41 c. 3, 45 c. 7, 47 c. 1, 49 c., 50 c. 2, 51 c. 1, corresponding to the classes A, B, C, D, E, and F. Among the females there was an analogous progressive increase.

To conclude, the increase of the diameters of the head and the increase of the length of the body are proportionate to the weight of the fœtus. Taking the Class B, weighing a little more than gr. 2000, and the Class F, weighing a little more than gr. 4000—that is nearly double—they find the diameters of the head of the last series measure one centimetre, sometimes two centimetres more.

A. R. URQUHART.

American Neurological Notes. J. H. SCARFF, M.D., publishes (*Virginia Medical Monthly*) four cases showing the value of chloral hydrate in obstinate vomiting of pregnancy. The method of administration is, 20 grains in solution night and morning, till 4 doses have been administered. In the same Journal chloral is referred to as having been successfully employed in cases of retention of urine, also associated with pregnancy. What we already know of chloral leads us to anticipate that in all such reflex-neuroses the drug is likely to be of great service.

Dr. Cullen, quoting from the *Italian Medical Gazette*, Venice, states that in hysterical and hypochondriacal affections camphor has been shown to be a powerful hypnotic. This statement, which many who have used camphor largely without arriving at such a favourable conclusion may be inclined to doubt, may have been justifiably made, as the camphor was dissolved in olive oil and administered hypodermically. It is highly probable that this time-honoured

drug has recently suffered much in reputation, owing to the difficulty experienced in exhibiting it in a soluble form. Camphor dissolved in olive oil and administered hypodermically might be well worthy of a careful trial in the sleeplessness of simple mania.

Kunze treats cases of epilepsy of long standing with curare. He uses a solution of 7 grains of curare in 75 minims of water, to which he adds two drops of hydrochloric acid. At intervals of about a week he injects subcutaneously about 8 drops of this solution. In various cases in which convulsions had occurred for several years, he obtained "a complete cure" after 8 or 10 injections.

Dr. T. Kennald publishes in the *New Orleans Medical and Surgical Journal* some excellent observations on sunstroke, based mainly on the 1878 epidemic in St. Louis. The fatal temperature began somewhat suddenly on July 10th, and continued without much intermission for about ten days. During this period the total mortality from all causes was 499, and 154, or 31 per cent. of these deaths was caused by sunstroke. It is notable that many more deaths were assignable to extreme heat, though not directly due to sunstroke. Thus there were 50 from *cholera infantum*, 17 from apoplexy, 40 from convulsions, and 34 from other diseases of the brain and nervous system.

Nervous exhaustion from exposure to an excessive degree of heat is maintained to be the true meaning of sunstroke, and humidity of the atmosphere is not admitted to have any share in the production or prevalence of the stroke. Neither is an intensely dry atmosphere required, the sole requisite being the uninterrupted continuance of high temperature.

Dr. Kennald does not seem to have directed his attention to the question of modifications in the potency of chemical rays as distinguished from mere high temperature; but he states that after the commencement of an epidemic many deaths occur on cloudy days in the shade, where the temperature does not range very high. "Persons debilitated by age and worn out from grievous sickness are often overcome by heat when they have not been exposed to the sun's rays at all, which proves that death is due to nervous exhaustion from the heat, and not to insolation." To some who have suffered severely in spirits and prospects from the prolonged absence of sunshine, the study of mortality from sunstroke may yield a lugubrious form of satisfaction.

Dr. Daniel Clark comments (*Canada Lancet*) on a statement said to have been made by Dr. Hammond, that he was in favour of punishing insane people just as he would a tiger who went about destroying people. If a lunatic had a homicidal mania, he would hang him. He would hang lunatics who had a mania to kill, even were that deed not performed. Dr. Hammond, if he is rightly reported, treads on dangerous ground. If such are his views, would he not be regarded by many as having a "mania to kill"; and run the risk of being treated like an American Haman?

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